American Machinist

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# Welding Pipes 30 Feet in Diameter

CHESTER B. LORD

MERE mass or size no longer excites the wonder that it once did, but when the size is such as to necessitate a new technique and give rise to new problems, it comes legitimately under the heading of "new stuff."

The Boulder Dam flood control, irrigation and power project will have 17 hydraulic turbines with a combined horsepower of 1,800,000. The penstocks for conveying water from the Black Canyon to and from the turbine units are being made by The Babcock & Wilcox Company of New York, N. Y.

The contract calls for the following diameters and lengths of pipe:

| *Length, Feet* | *Diameter, Feet* | *Thickness, Inches* |
|---|---|---|
| 4,700 | 30 | 1 11/16 to 2¾ |
| 1,900 | 25 | 1⅝ to 2 5/16 |
| 5,600 | 13 | 15/16 to 1 5/16 |
| 2,300 | 8½ | ⅝ to ⅞ |

Pipe 30 ft. in diameter, made of 2¾ in. thick steel plate has seldom if ever been made. Even the huge Scotch boilers for ocean steamships do not approach this diameter. The edges of plates used in Scotch boilers are drilled for rivets and bolted together until riveted. This arrangement is much easier to handle than the blank plates used on this job.

The sizes of the pipes made it impractical to do the fabricating and welding at the home plant. The tunnel and bridge clearances on the transcontinental railroads are about 15 ft. overhead and about 8 ft. at the car platform level. This made necessary the establishment of a field fabricating plant.

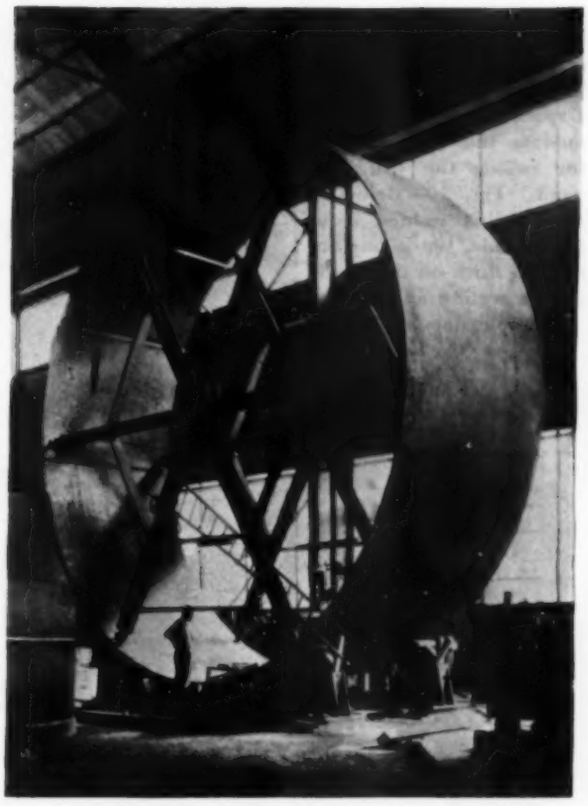


**Fig. 1—Single section of 30-ft. diameter penstock. A section of this diameter is not self-supporting and must be supported by spiders**

The Illinois Steel Company rolled the steel and the 32 x 12 ft. x 2¾ in. plates are the largest that can be rolled and shipped by rail. Each of these plates weighs 23 tons and only two can be shipped in a car. The total tonnage of plates ordered for this contract is 45,000 tons.

Three of these 32 x 12-ft. plates, placed end to end lengthwise after forming, make one ring of pipe 30 ft. in diameter and 12 ft. in length. Two of these lengths and a stiffener member are assembled and welded together to form one assembly section weighing about 150 tons. A single section is shown in Fig. 1.

The first operation on the plates after reaching the field is to lay out to proper dimensions. Any excess length or irregular edges are trimmed with an oxy-acetylene cutting torch. The edges are then planed in a 40-ft. Wm. Sellers & Co. plate planer, the largest planer of this type ever built. The edges are planed so that when two plates are butted together, the edges form the shape for electric fusion welding.

After planing, both ends of the plate are bent to the desired radius by two 1,500-ton presses acting as a unit, being tied together top and bottom with heavy girders which carry the bending

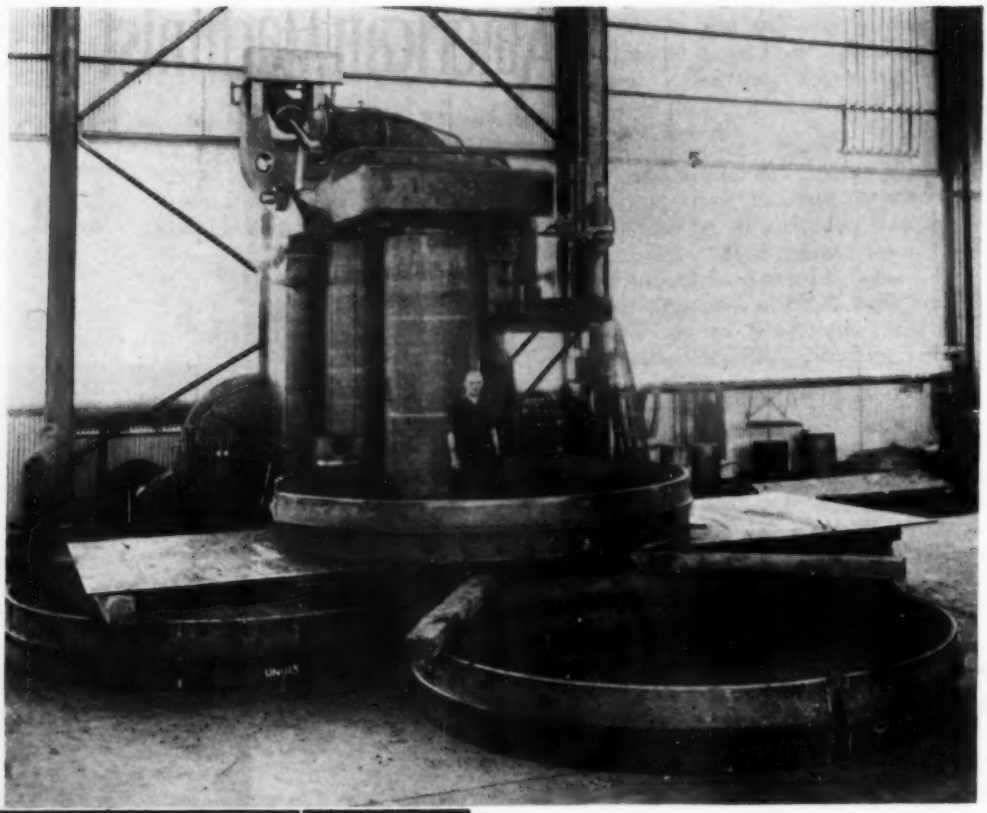
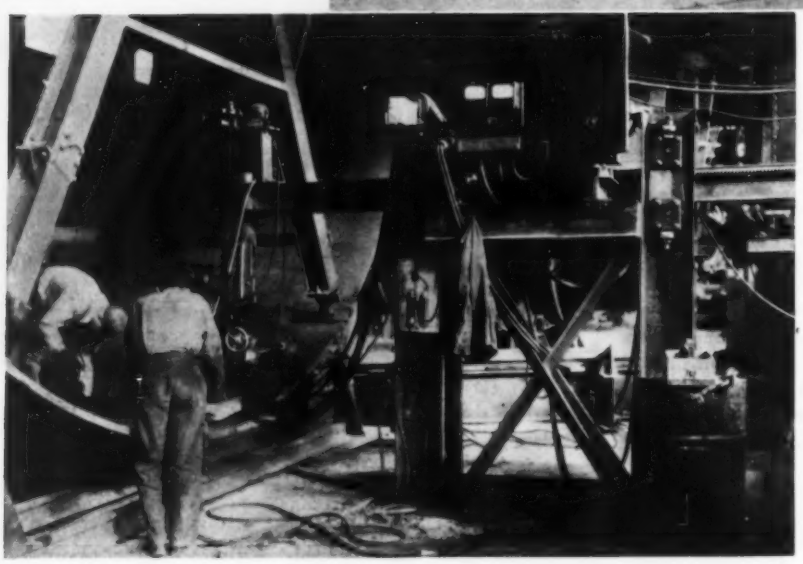


**Fig. 2 — Right — Vertical rolls weighing 300 tons. Two rings or collars with a space between to accommodate the rib are used for rolling the stiffening band. Fig. 3 — Below — After being welded from the outside, the seams are clipped flush on the inside of the section and a final weld deposited**



dies. The presses are actuated by oil at 2,000 lb. per sq.in. pressure. The pump used is of the rotary type, driven by a 30-hp. motor. Unless this preliminary bending of the ends is done, each plate would have a flat section at each end that the rolls would not bend.

For forming the plates, a vertical plate bending roll is used, Fig. 2. This roll has two 32-in. diameter rolls and one 40-in. diameter roll. All rolls are 12½ ft. long. The two 32-in. rolls are driven by a 150-hp. motor. The 40-in. roll is driven by the friction of the plate being rolled. This 40-in. roll is movable in respect to the other rolls and moves in and out, driven by a motor and against a roller thrust bearing, in order to change the curvature of the plate being rolled. The three rolls are capable of imposing a load of 1,750 tons on the plate. Like the planer above referred to, these rolls are the largest ever designed for the purpose. They weigh 300 tons.

After bending the plates are clamped to two large spiders and are then ready to have the longitudinal seams welded. For welding, a General Electric a.c. 60-volt welding machine is used with Babcock & Wilcox automatic feeding mechanism and flux coated electrodes. This welding operation is illustrated in Fig. 3.

Two rings, each approximately 12 ft. long, are assembled with a fillet insert section, which is approximately 21 in. wide, on internal expanding spiders. The welds between each ring and the fillet insert are then done automatically. This fillet insert section is a specially rolled member to which is welded a T-shaped stiffener ring designed to keep the pipes round and to transmit the load from the pipes to the supports and foundations. A flat band is then shrunk on one end of the pipe section thus formed and welded thereto inside and outside, making the bell end of a bell-and-spigot joint.

Near the opposite end of this same section a steel ring is shrunk to the pipe section to constitute a reinforcing ring at that point.

All welding is done in accordance with the A.S.M.E. Code for unfired pressure vessels, Class 1. For inspection purposes, two of the 325,000-volt General Electric portable X-ray machines shown in Fig. 7 are used. During the contract, it will be necessary to use these machines for exploring about 400,000 linear feet of welded seams.

When these sections have passed the various tests required, they are placed in a vertical position in a furnace to relieve them of the stresses set up in the process of fabrication. This furnace measures 36 x 41 ft. x 28 ft. 3 in. in

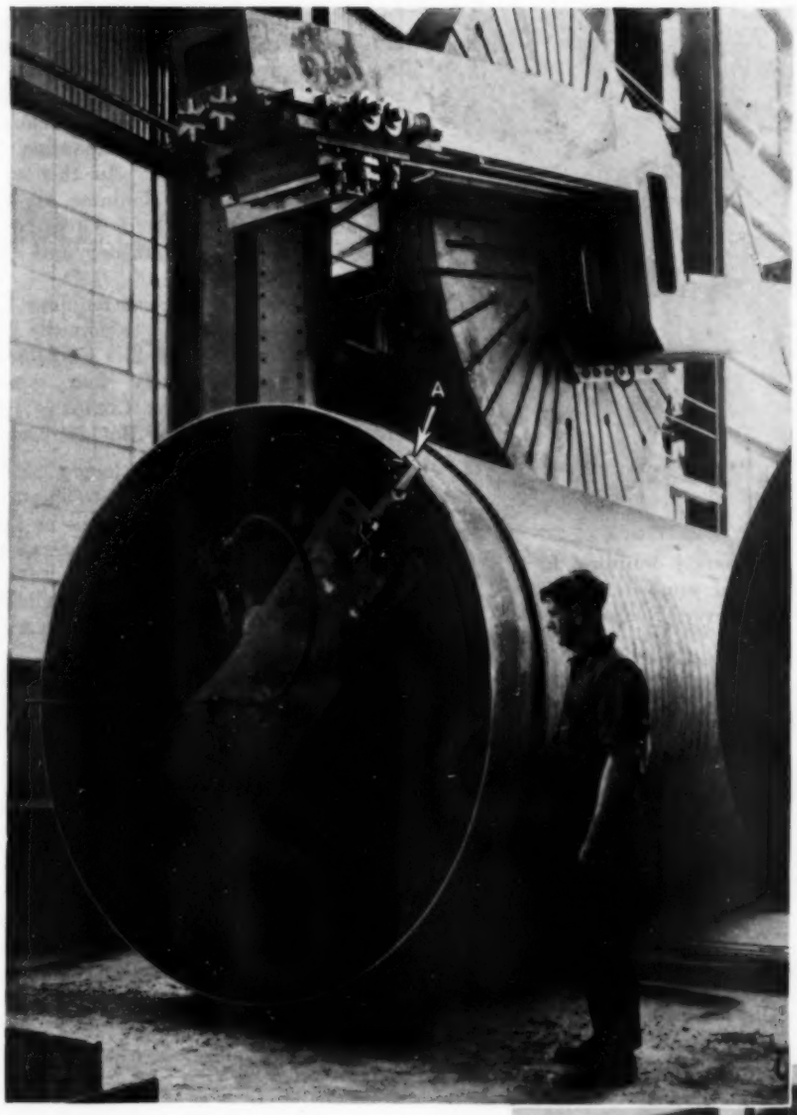



**Fig. 4—A hydraulic spider or cat-head is inserted in the sections and adjusted until the scriber *A* shows the section to be round. It is then faced on the machine shown**

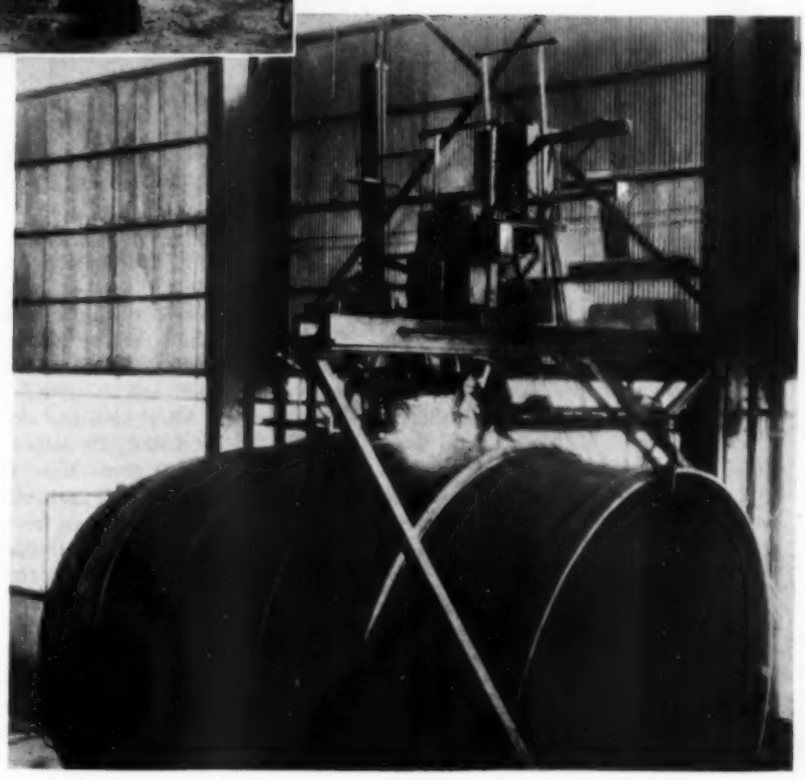
height inside. The furnace is of the car bottom type with the front or door integral with the car bottom. The combustion chamber for this furnace is separate and the hot gases are conducted to the furnace through insulated flues. The gases enter the furnace at the bottom at one side and exhaust at the bottom on the opposite side as shown in Fig. 6. The direction of flow is reversed every five minutes to maintain an even temperature on all sides of the pipe. The fuel consumption is a little over 100 gal. per hour for the heating period and about 35 gal. per hour for the soaking period, which is at the rate of 1 hour for each inch of thickness of pipe. At the end of this period the fuel is shut off and the pipe allowed to cool in the furnace until it reaches a temperature not exceeding 600 degrees F. The section is then withdrawn from the furnace. Test coupons representing the seam accompany and receive the same treatment as the pipe sections. Tensile test specimens as stipulated by the A.S.M.E. Code are machined from these coupons, and if they show tensile strength at least equal to the original plate, specific gravity 7.80, minimum elongation at least 30 per cent and withstand cold bend test without cracking, the pipe section is approved.

Each section is fitted with hydraulic spiders, to keep it rigid and round, and is mounted on a lathe and faced and bored at the ends. The face plate of this lathe is shown in Fig. 4.

Following this the sections are mounted in a vertical position on a drilling machine which drills the pilot holes that later become the pin joint holes in the girth seams when the pipes are made up in the tunnels. These holes are drilled in both ends of the pipe simultaneously with a double set of drills, mounted one over the other.

The pipe is later sand blasted and given a primer coating and is then ready to be transported into the tunnels for erection. There are four tunnels, two on the Arizona side of the Colorado

**Fig. 5—Two welded sections are joined to make one assembly section. The circumferential seam is being welded automatically**



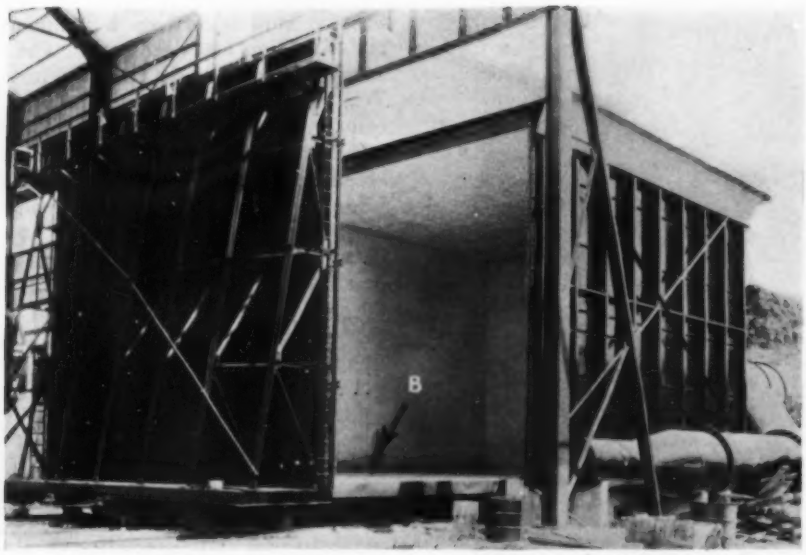



**Fig. 6—The normalizing furnace is a separate building by itself. The gases enter at *B* and leave on the opposite side at the bottom. Inlets and outlets are reversed every five minutes**

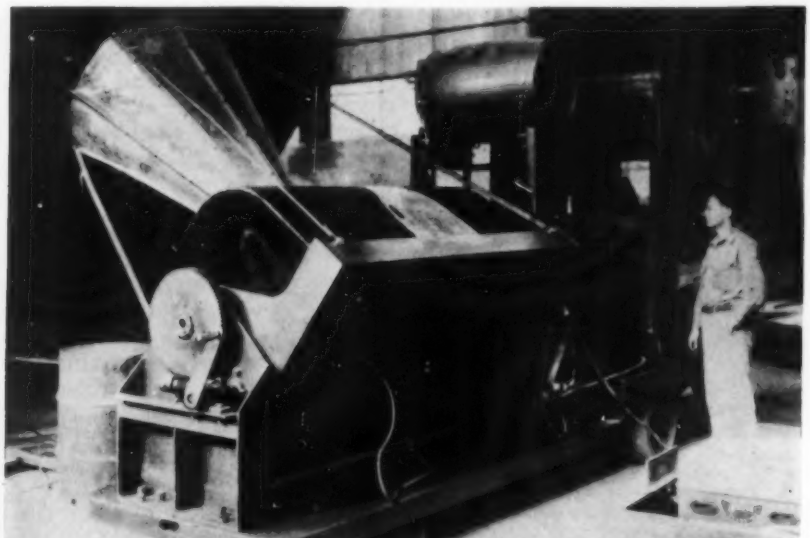


**Fig. 7—Each weld is inspected with this 300,000-volt X-ray machine. There will be a total of 400,000 ft. of seams**

river and two on the Nevada side. Each tunnel is approximately 1,000 feet long.

The sections are transported from the fabricating shop to the rim of the canyon, are lowered by cableway to shelves cut into the rock in the canyon wall, placed on a car there and moved through the entrances into the tunnel. They are thence drawn by hoisting apparatus to their position for joining to the preceding section.

Eventually the bell end of each section is to be expanded by raising its temperature with electrical units, the spigot end inserted and the joint allowed to cool. The pilot holes that were drilled in the shop are then reamed and broached to size. This is done by turntable spiders carrying a Baker drill and a broaching machine made by the American Broach & Machine Co. The drill and broach are mounted 180 degrees apart. After half the circumference has been drilled, the other half is drilled and at the same time the first half is broached. The broach has a pulling capacity of 35 tons for drawing the broaches through the drilled holes. The holes are then fitted with ground pins by the broaching machine which imposes 40 tons thrust upon the pins in driving them into their seats.

For final erection expansion joints of the conventional design are not applicable. It is therefore necessary in making up the joints in the tunnels to refrigerate the pipe to the minimum operating temperature and join it up when the line of pipe is in its fully contracted condition. The entire line will be so installed and provision for movement will be so made that the expansion of the line is provided for. In this way it will be possible to eliminate an expansion joint which would not be feasible for the 30 ft. diameter and the head of water used.

To house the equipment required for fabricating this pipe and to domicile the personnel who are to do this work for a period of approximately four years, The Babcock & Wilcox Company has erected on the site near Boulder Dam:

1 Shop building 520 ft. long x 85 ft. wide x 55 ft. high from floor to chord of roof truss. The steel columns in this building are spaced on 25-ft. centers and carry three 75-ton cranes.

1 Leanto against the shop building which is 150 ft. long x 20 ft. wide x 12 ft. high.

1 Office building 80 ft. long x 28 ft. wide with basement and attic.

2 Six-room dwelling houses.

6 Five-room dwelling houses.

4 Four-room dwelling houses.

7 Two-story apartment dwellings having 4 apartments in each.

1 Two-story dormitory with 100 8 ft. x 10 ft. rooms.

All living quarters have hot air heat, gas or electric cooking stoves, gas water heaters and electric refrigerators. Each room in the dormitory for single men is air conditioned, and the commissary furnishes good subsistence at a nominal cost.

## Cylinder Bores Once More —*Discussion*

JAMES MCINTOSH

John R. Godfrey (*AM*—Vol. 77, page 666) refers to a method used to aid lubrication of an automobile cylinder.

The reference to the use of a pointed tool to improve cylinder bores recalls a similar use to retain jointing material between flanges of pipes and other detail where a milling cutter was used. This special work was done with a simple cast-iron cutter head. One tool-bit was ground to trail the others and was pointed to a 30-deg. included angle, the corner being rounded to remove the sharp point.

With a feed of 0.125 in. and a single cut we produced an ideal joint surface with a network design due to the single-pointed bit, the pitch being equal to the feed. How about it? Why not apply this to cylinder bores?

# Dangers of Delay in Protecting Inventions

**H. A. TOULMIN, JR.**
*Toulmin & Toulmin*

**To get and keep a patent is a ticklish business; particularly so if you don't know how the Patent Office and the courts regard: lack of recorded evidence, rights in an interference case, delays in filing, lack of diligence and abandonment**

THE GREATEST foe of success in protecting inventions is delay. Business executives who do not have occasion to deal frequently with patent property are usually not aware of the fact that steps to protect inventions must take place within a certain limited time.

A manufacturer of an ensilage cutter in northern New York took the usual course of all conservative executives in advertising his ensilage cutter as soon as he launched it on the market. He waited before filing his patent application until he was sure that the article was going to be a commercial success. But he waited too long. His first advertisement appeared two years and one month prior to the date of his application for a patent. Later, when he came to issue on his patent, his competitor produced the former's advertising and invalidated his patent, for the law requires that a patent application must be filed within two years from the first public use, sale or publication of the invention.

Of course, many pioneer inventors have been too early with their inventions. The case of Thompson, who invented the pneumatic tire in 1847, is one in point. His invention lad dormant for more than forty years or until Dunlap again invented it in 1888. As a consequence, not only was the original inventor without any compensation, but, due to his prior publication, the subsequent Dunlap invention was invalidated. Thompson was too early for commercial success and Dunlap was too late for patent success. What a vast fortune was thus lost can be easily appreciated.

But inventors and the owners of patents who wait the full two years run many other risks. The principal risk is of a competitor filing his application on the same invention. Then there is a contest in the Patent Office as to which one was the first inventor. This is called a "Patent Office Interference." The Patent Office records show that the chances of winning in a Patent Office Interference are three to one in favor of the inventor who was first to file his application. The presumption of the law is that he is the first inventor as he was the most diligent in protecting his ideas.

To offset this advantage the second inventor must prove that he was the first to think of the idea and the first to reduce it to practice in a practical form by building it, or he was the first to think of it and, while the last to build it, yet he was busily engaged from the time he thought of it until the time he built it in order to prove that he was diligent. Any neglect by this party, and it is easy to show neglect, will be fatal to him.

A manufacturer of trailers had an experience that is a good illustration of the danger of a prior application. He had an idea for a trailer, built the trailer, found that it worked successfully and then dismantled the parts for use in building another trailer. Time went on and he filed his application in the Patent Office, but, in the meantime, a competitor had filed his application. The contest was on. A large sum of money was at stake.

The man who had been first to think of the idea and first to build the apparatus, but who had been neglectful in filing in the Patent Office, lost, because he could not satisfactorily convince the Patent Office of the existence of the model because he had taken it apart and thrown it away. That action of his was taken to indicate that he was either intending to abandon the idea or that the experiment was not successful.

The law encourages inventors to do the necessary experimental work to be sure they are on the right track before they file their applications. But this encouragement must be taken with a grain of salt.

The Patent Office will not excuse delay in filing an application or building the apparatus first just because the inventor is poverty stricken. Lack of money is no excuse.

But where there is some question that the apparatus will work and one inventor takes time enough to build it to prove that it will work, he will not be held to have lost his invention to the man who has rushed into the Patent Office without taking this precaution.

### Haste Not Legally Necessary

The law does not require inventors to disclose their ideas and rush into the Patent Office within the two year period for they may keep their ideas secret. But woe to the inventor who lets the news of his invention get out and then files his patent application more than two years after that, for the law says:

> "Inventors may, if they can, keep their invention secret, and if they do for any length of time they do not forfeit their right to apply for a patent, unless another in the meantime has made the invention and secured by patent the exclusive right to make use and vend the patented improvement. Within that rule and subject to that condition inventors may delay to apply for a patent."

A good example of the effect of delay and how it causes loss is the case of a man named Mason who invented a detachable clip for a shotgun. He made a satisfactory test of this in 1887. The gun with its attached clip in working condition was hung up and concealed in the inventor's storeroom for seven years. In the meantime, another inventor made the same invention. A short time later he was granted a patent. Mason, the first inventor, upon seeing the patent and being jealous like all inventors, immediately rushed into the Patent Office to get a patent for himself on the same thing. The second inventor won. Mason was held to have thrown away his rights because he had

practiced concealment while another more diligent man had gone into the Patent Office to protect his ideas and to give the public the benefit of them.

In the case of another inventor named Wood, who had filed an application, the inventor failed to take proper action in the Patent Office and his application became forfeited. He afterwards tried to renew it. Meanwhile, a second inventor, named Barber, got a patent on the same thing that Wood was manufacturing but without knowing anything of Wood's secret application which had been forfeited. Wood was denied a right to revive his application and to get the patent because it was held that he had unnecessarily delayed while another more energetic man was making the invention available to the public by prompt action.

### Outside the Limit

Controversy frequently arises as to what constitutes an act by the manufacturer that will put him outside the two-year rule. Take the case of a cash register manufacturer. The invention had not been completed to the satisfaction of the manufacturer and was not ready for sale even though the general machine was offered for sale prior to the two year limit. This delay was not sufficient cause to defeat the filing of the patent. In another case a manufacturer of electrical devices entered into a contract for sale of a device; subject to approval by the buyer of a sample to be afterward submitted, but the sample was not furnished or approved within the two year period. This incomplete transaction was not considered a defeat of the patent. A chemical manufacturer used a process secretly for more than two years before he filed his application for a patent and openly sold the product from the process. Even though the patent was not on the product the court said that this would defeat the patent as such a use of a process was not an experimental one, even though kept secret. Where an inventor or the manufacturer owning the invention spends the time and effort in exploiting the invention commercially, it is not considered an excuse for delay in filing an application. It is not considered as an excuse for testing out the efficiency by actually building it.

There are only two ways to protect rights to an invention; that is, to file the application promptly or to build the invention, or both.

But just building the invention, which is called reducing it to practice, is not enough. If, after that, the owner of the invention delays for an unreasonable time to take steps to make it available to the public and to protect it by a patent, while in the meantime another independently invents and patents it, the earlier inventor forfeits his right to the patent in favor of the later and more diligent inventor. The fact that the inventor conceals and suppresses the invention, after he builds it, until a more diligent man comes into the field for a patent which he promptly applied for, is usually regarded as an abandonment by the first inventor. That is the reason why those who try to keep their inventions as trade secrets will not be given the privileges and protection of the patent laws.

Some years ago a manufacturer of machinery had certain trade secrets in the design of his machinery and its manufacture, but very diligently kept his doors locked, his formula in the safe and his whole establishment under guard, but some of his employees moved away and much of his information became public property. It was then too late to apply for patents and his competitors got the information and were able to take advantage of his years of experimental development work without paying a cent for it.

The safe rule for inventors, therefore, is just the same as for any business: prompt, careful and thorough attention to the establishment of every record relative to the invention.

## Wanted—A Voice for the Non-Union Worker

### *Discussion*

I. B. RICH

Our old friend Lucien I. Yeomans (*AM*—Vol. 77, p. 659) makes the mistake of most enthusiasts and paints one side lily white while the other side is of a decidedly dusky hue. In next to the last paragraph, for example, he states that "seven per cent stand for nothing the other ninety three per cent want." If this is true, if no non-union men are interested in shorter hours, higher pay and better working conditions, they are hardly the high grade, forward-looking men he would lead us to believe.

I, too, am an old-time machinist who never joined a union. I also worked sixty hours a week. But except in cases of emergency, as in war, it is much too long. And there seems to be no doubt that the unions, with all their faults, have been largely responsible for the shorter hours and higher pay. It is extremely doubtful if the individual worker, without collective bargaining, would have secured these concessions.

I heartily agree with Mr. Yeomans on many points, especially his description of the so-called open shop, about which we have had more hypocritical bunk than any one subject I recall at the moment. As Yeomans says, there isn't any such animal, in spite of all the flag waving about it.

Both Yeomans and I belong to the day when there were few large shops, few manufacturers associations and when labor organizations were in their infancy. All have grown, and not always for the best. Sympathetic personal relations that were common in many of the small shops become difficult as plants grow, as men become numbers instead of Mike and Bill. A few grasping employers made unions necessary. Good union members suffer from bad actions just as considerate employers suffer from unscrupulous members of their trade associations.

I know union men who are just as earnest and honest as Yeomans or I. They are just as much union men by conviction as the non-union men who possess all the virtues in Yeoman's eyes. They believe that because of their sacrifices all mechanics are getting better wages. Most writers on economics agree with this belief. If the seven per cent have improved conditions for all, they may well stick out their chests and do a little crowing.

If the "share-the-work" movement was such a laudable thing as Mr. Hoover and Mr. Teagle told us, why should Yeomans throw stones at the union men who sacrifice ten cents an hour to help a less skilled fellow worker? Yeomans called them "dumb loafers" but we have thousands who are not loafers even though below mental par. If the vindictiveness displayed by the advocate of the submerged 93 per cent is typical, I'd be inclined to join up with the unions were I back in the shop again. And if the 93 per cent want a "voice," I'd suggest they find one that will not repel fair minded men by its prejudices.

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### Progress as Told by the City Dump

The trend of the times as well as the stages of development are shown effectively by the articles found on the city dump. One exhibit at the Century of Progress showed this very clearly. Kerosene lamps, ornamented clocks, old model typewriters and phonographs mark the periods of 30 years ago. The old coffee pots were followed by the percolators and drip devices. Old incandescent lamps are followed by wornout radio tubes and batteries. All through the 30 years can be seen the advance in sheet metal work. The percentage of articles made by stamping and forming grows larger as the years go by.

## Steel Ways and Scraping *Discussion*

ROBERT S. ALEXANDER

Reading John R. Godfrey (*AM*—Vol. 77 page 638) on the above topic sets me thinking: Have we not, in view of the improvements made in grinding methods and equipment, and progress in lubrication devices, made a fetish of this practice of scraping cast iron surfaces, to the exclusion of any serious consideration of the relative values involved?

There can be no reasonable doubt in our minds as to which operation is the more economical. Grinding, when compared with the more laborious and exacting task of scraping wins hands down. What, then, can be the justification for the more costly method? Appearance, lubrication, closer and more accurate adjustment, have all been suggested. Let us examine each of the above claims in the light of present day practice.

Appearance: No one can deny that a well scraped surface, "frosted" as only expert workmen can, presents an attractive appearance. An equally fine finish can be obtained on the grinder. Do we need the frosting?

Accurate adjustment: With present day grinders capable of turning out work to the "split thousandths" there should be no difficulty in securing as good a bearing surface as is produced by hand scraping.

Lubrication: While the low spots left by scraping act as oil reservoirs, they also attract loose filings and fine chips, which are harder to remove than they would be on the more uniformly smooth ground surface. Here, the grinding wheel with its cutting-polishing action is better equipped to offset the inherently porous character of cast iron. A comparison of a scraped and a ground cast-iron surface under the magnifying glass will bring out my point clearly. This would seem to indicate that from the angle of longevity the ground bearing surface is entitled to preference. I would be interested to know if there are any data available as to the relative merits of scraping or grinding where cast iron ways are concerned. So far as I have been able to ascertain there has been no attempt made to check wear resistance on finishes obtained by either process.

Mr. Godfrey also mentions steel ways run on steel. To my mind there seems no reasonable objection to this form of sliding contact, particularly where machine tools are concerned. But from my own observation this innovation, long overdue, is still in the pioneer stage. It may be that the factor of cost has precluded the use of the hardened and ground steel way, for after all, to superimpose steel ways on the cast iron of a heavy lathe bed calls for extra machining of an exacting nature, both on the ways and on the lathe bed. From a production standpoint it might be better to put the extra cost into securing a tougher grade of iron, and let it go at that.

Grinding high-nickel content iron ways, instead of scraping, would help to reduce first cost and from a humanitarian standpoint be beneficial. After all, having almost eliminated the man with the hoe from agriculture, why not remove the man with the scraper from the shop?

## Standardizing Die Construction—*Discussion*

M. P. DALTON
*St. Anne's, Kent, England*

Referring to the article by F. Server under the title given above (*AM*—Vol. 77, page 542), the use of round dies may well be stressed. Presses can be cheaply fitted with tools by using bolsters bored to the size of standard steel bars.

For each job, a piece of the bar is cut off in the lathe. While centered in the chuck it is usually easy to mark center points and to bore the circular parts.

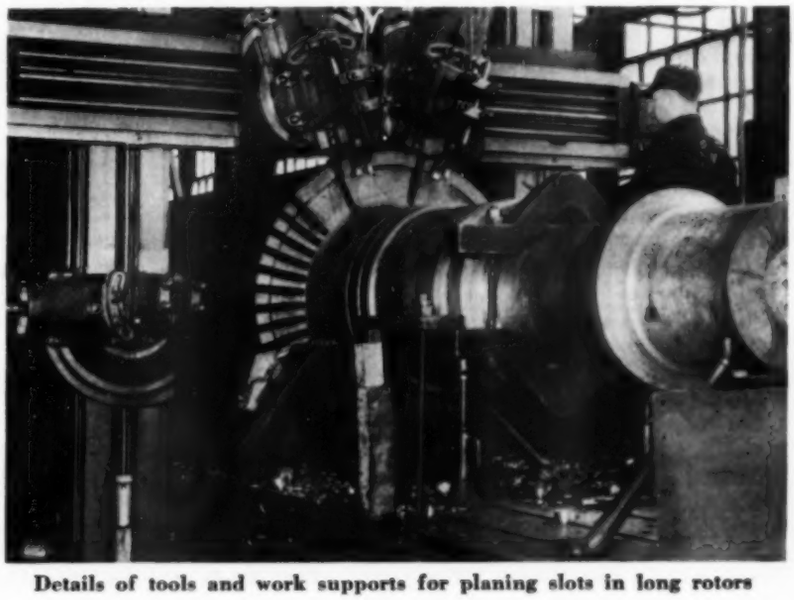
The use of jigs for handling the die-blocks is an important point and they should be used for holding the blocks on the bench, for all drilling, for relieving in filing or slotting machines, etc. Punches can be fitted to thin plates attached to standard punch pads made by turning stems on pieces cut from a bar. Thus, all tools can be employed in any press by the use of standard adapters.

Finally, there is generally much waste of punch material. Where the production is comparatively small, and with standard punch pads, much more use might be made of punches cut out of ground plates and attached to standard punch pads by screws, the holes for which are jig drilled.

## Planing Slots in Long Rotors

Rotors for direct-connected turbine generators make up in length what they lack in diameter, in direct contrast to the old, large diameter slow-speed rotors. The slotting of these rotors requires a good sized planer and is a job where a good planer hand has an opportunity to show his skill. Such a job was undertaken in the plant of the Allis-Chalmers Mfg. Co., Milwaukee, Wis. A close view is shown, with the end of the rotor body under the crossrail showing how two tools are used in each tool block, the first or narrow tool being on top of the other. The narrow tool roughs out a central slot. The second tool follows it through the work, cutting the slot to the desired width. Two tool heads enable machining two slots at the same time.

This view also shows how the rotor is held against turning by locking one end of the heavy clamp between the jack on the table and the strap above it. On some work of this kind an index plate on the end of the rotor is used for spacing the slots.



**Details of tools and work supports for planing slots in long rotors**

# Accuracy in Airplane Propeller Making—II

**FRED H. COLVIN**
*Editor, American Machinist*

**Like those that have gone before, these operations show the precision work that must go into an all-metal adjustable-pitch propeller**

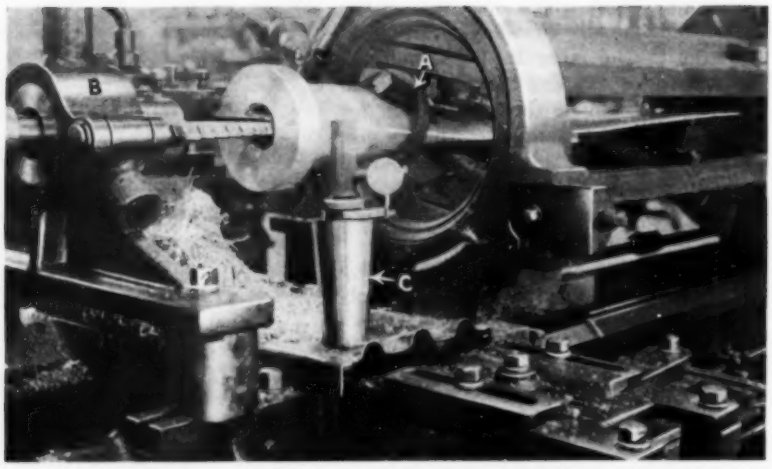



**Fig. 14—Boring the hub end of a propeller blade. This view shows the work fixture, toolholder, gage and steel retaining ring**

THE BLADES of the Hamilton Standard propellers are forged from 25-ST aluminum alloy and show a Brinnel hardness of 100. These blades are forged very carefully to size and shape, the contour having a vital bearing on the efficiency of the finished propeller. After the blades are forged and before the inner or hub end is upset, the heat-treated retaining ring *A*, Fig. 14, is slipped over the end. This ring makes a simple and efficient method of holding the blade in place by the centrifugal force of approximately 1800 r.p.m. This ring fits the large fillet turned on the hub shoulder.

The hub ends of the controllable pitch propeller blades are bored for the beryllium bronze sleeve which is pressed into the blade end and forms the bearing for the blade when it turns on the steel spider. This makes it necessary to have a uniform taper in the blade end and to hold it to size. The original method of boring the blade is seen in Fig. 14, the blade being held in a fixture or cradle, the outer end having a bearing in a support fastened to the lathe bed. The hole is first drilled to the minimum diameter and then tapered by a series of step-toothed reamers, one of which is shown in the tool holder. The tool holding unit is supported by bushings held in the support *B*. The finished hole must be of correct diameter and taper to receive the bronze bushing as shown in detail in Fig. 16. To insure the hole being right for the bushing the plug gage *C*, Fig. 14, with a dial indicator for depth, is used in checking the finished hole. The axial tolerance is plus or minus, 0.001 in. The blade is run at about 325 r.p.m.

A new method has been adopted for boring the hubs, involving the use of a special vertical machine, Fig. 15. Here the propeller blade is held in the vertical slide and fed down on the tools. The roughing tool *A*, shown in position, is virtually a step-drill having ten steps, each of a larger diameter than the one ahead. The work being inverted, chip clearance and disposal take care of themselves. Following this is the roughing reamer *B*, which has a few straight cutting edges, grooved to break the chips. The hole is finished by the back hand spiral reamer *C* which also has nicked cutting edges. The tools are held by the lugs or ears, just above the taper end portion that centers the tool in the spindle. These lugs are milled from the solid.

Hub details, Fig. 16, show the bush-

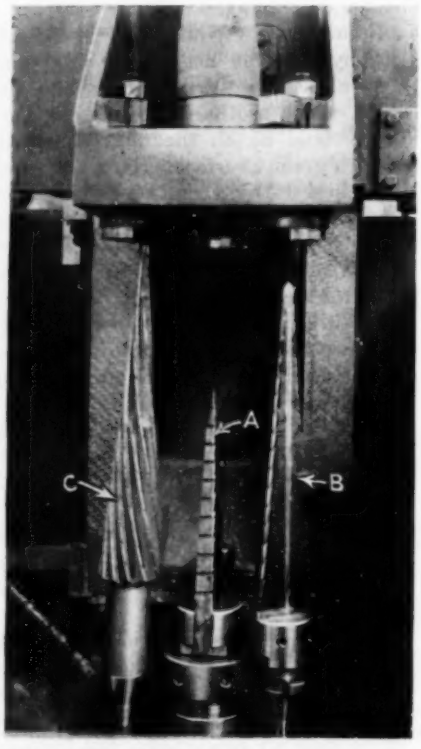



**Fig. 15—Boring tools, reamers and workholder on new vertical machine built especially for the same kind of work**

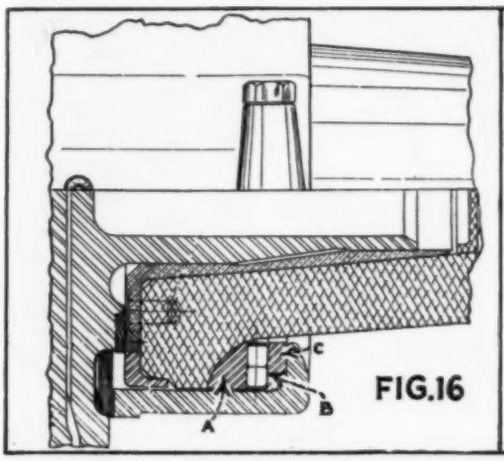
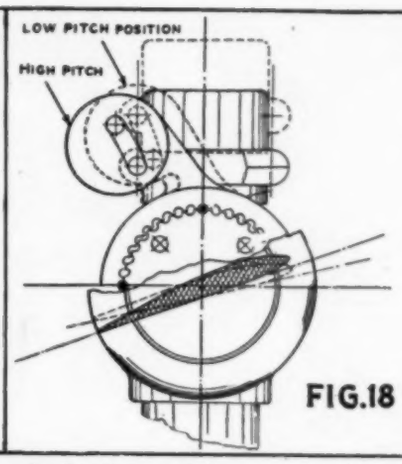



FIG.16



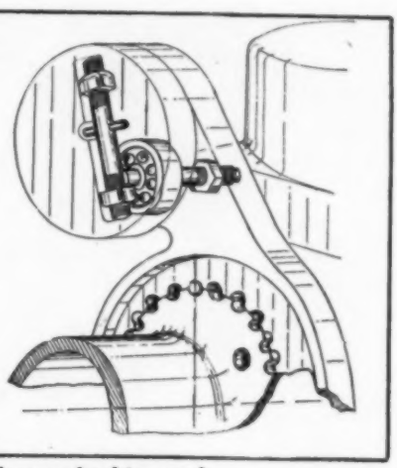
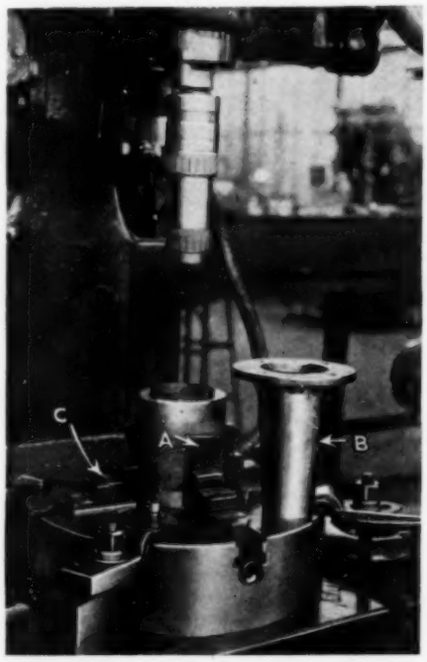



FIG.18

**Fig. 16—Details of the hub end, showing retaining ring in place—bronze bushing and roller thrust bearing as assembled. Fig. 18—Details of the positive angular adjustment and the controlling mechanism both of which have been very carefully worked out**



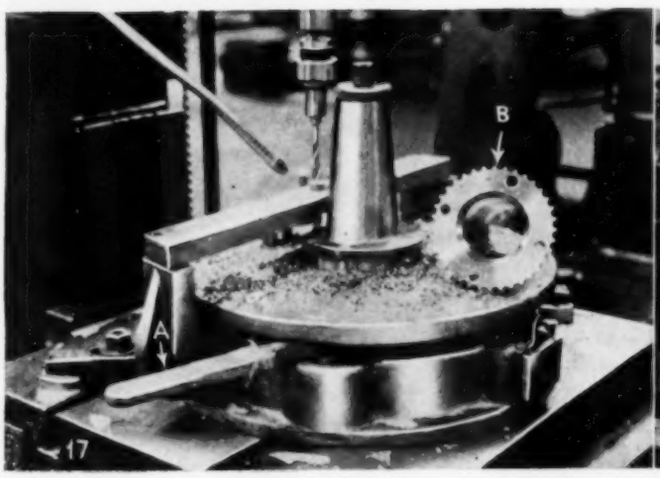

ing in place, with its taper bearing in the hub and the two straight bearings on the central spider. The retaining ring shown at *A* in Fig. 14, is here seen in position. Outside of this is a roller thrust bearing B, both the roller cage and the retaining ring *C* being made in two parts, the barrel, previously described, holding the assembly in place.

The hub bushing of beryllium bronze presents quite a machining problem owing to its hardness and cut-resisting qualities. It Brinnells at 375 and requires high speed drills and tungsten carbide reamers to secure satisfactory results. The drilling fixture is seen in Fig. 17. This is a ratchet fixture, operated by the lever *A*. The drill is guided by the bushing in the bar at the rear. This fixture drills 36 holes in the flange near the edge. The outer diameter is then turned off to leave approximately half of the holes, as seen at *B*. These holes allow adjustments of the blades in relation to the angular counterweight arm, which has 40 half holes. The two are locked together by four hardened pins 90 deg. apart. Removing these pins and moving either part one notch, gives an adjustment of one degree. This adjustment and also the controlling mechanism is shown in Fig. 18.

**Fig. 19—After the bronze bushings are bored and reamed they are burnished with the roller tool shown while located in a special holder**

The bearing in the sleeve, where it works on the spider extension, is finished by a roller burnishing tool as in Fig. 19. These rollers are highly polished and leave a burnished surface in the bushing.

Control of the blades is secured by a cam cut in the lobe of the actuating counterweight arm shown in Figs. 20 to 23. One of the first operations is seen in Fig. 20, where the center is being bored and recessed for the notched edge



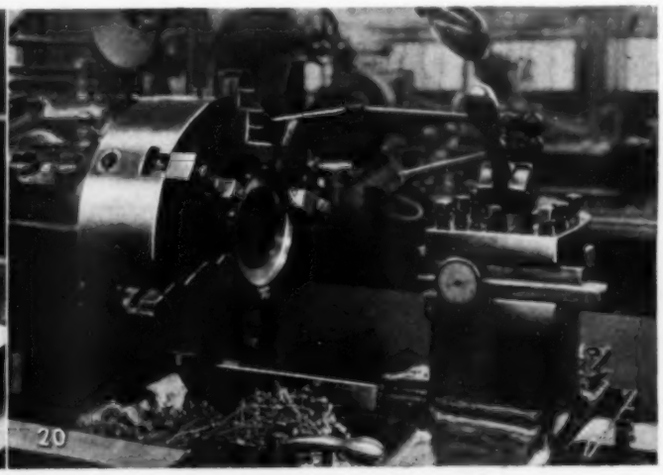
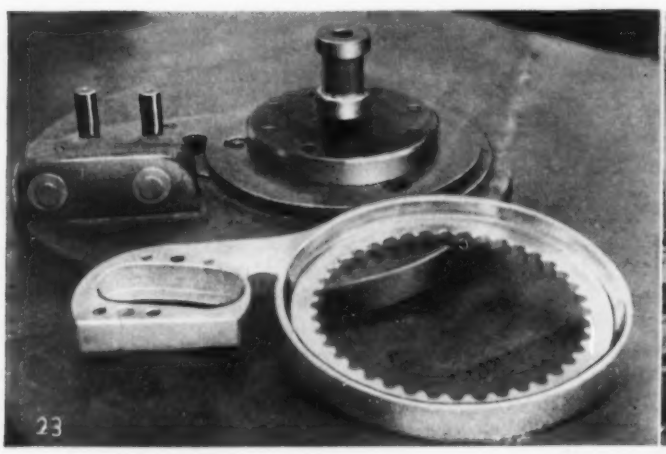




**Fig. 17—Drilling beryllium-bronze hub bushing in an indexing jig. Cutting away the outer edge leaves the 36 teeth shown. Fig. 20—Counterboring one of the counterweight arms to receive the notched edge of the bronze bushing. A dial indicator shows the exact depth**

**Fig. 21—Profiling the edge of counterweight arm, using coarse helical-tooth cutter, rotary table and guide form for outline. Fig. 22—Special fixture for milling curved slot in different sizes of control arm. Motion is obtained from regular feed mechanism of machine**



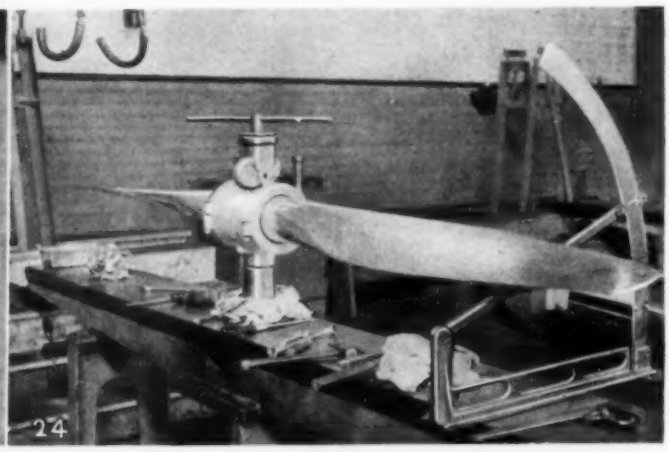




**Fig. 23—Completed actuating counterweight arm and gaging fixture for various dimensions. This has 40 teeth for angle adjustment. Fig. 24—Checking a two-bladed controllable pitch propeller. Here both the fixed setting and the amount of variation given by control mechanism are checked**

of the bronze bushing. This is a simple chuck job in the lathe, the interesting feature being the use of the dial indicator clamped in the tool post for showing the depth of the recess. The arms are profiled on the edge, in pairs, as in Fig. 21, using a modern vertical miller with a circular table, and a coarse tooth helical cutter.

Holes are drilled at each end of the curved slot in the control arm after which the arc is cut on a vertical miller, using the very ingenious fixture shown in Fig. 22. The arm is clamped in position on the swinging plate which pivots at *A*. Motion is secured from the slotted disk *B* and imparted to the plate by the connecting rod *C*. The slotted plate is rotated by means of a worm and gear, the worm being driven by the regular feed mechanism of the machines as at *D*. By making the disk slotted the fixture serves for more than one size of arm. Starting at one of the drilled holes the cutter completes the curved slot into the hole at the other end. The slot is recessed to receive the roller shown in Fig. 18. This recess is clearly seen in Fig. 23 which also gives a better view of the completed actuating counterweight arm. Here the 40 holes have been cut away to leave notches for the four locking pins and the arm finished all over. The material is 6135 chrome vanadium which Brinnells at 290 to 320. High speed tools are used in machining it. This gage checks the position of the cam slot with relation to the holes and the flat face in relation to the slot. Two "feel" plugs contact the flat face.

In Fig. 24, is a completed two bladed controllable pitch propeller on the test stand to be inspected. The angle gage in front checks the angle of the blade in both positions of the control, and the control itself is tested for freedom of action in all operations. No one not familiar with the requirements of airplane propellers can appreciate the necessity for both balance and "tracking" of the blades being as nearly perfect as possible. Vibration caused by engine, plane, or the air itself must all be considered and the result is a demand for a degree of accuracy that puts propeller making in the class of precision work.

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### Grinding on the Bias

A new rail joint grinder holds the 8-in. grinding wheel at an angle as it moves over the battered joint. This is said to take out transverse corrugations and leave a surface that lets the car wheel ride the top of the ridges. This cuts out the hammer, or bumping effects and the ridges are soon rolled into a smooth running surface.

# Effects of Their Own Code . . . and the Textile Code . . . on Builders of Textile Machinery

**Last of four articles analyzing NRA codes and their application to three important branches of the machinery industry**

HOW ARE the codes working? The steel industries have asked for the continuance of theirs. What about others? In order to get first hand information we have personally visited leading manufacturers of textile machinery and secured their reactions to the operation of their code.

One outstanding and significant fact brought out is that no single factor can be taken by itself. While the business in textile machine building has shown a most satisfactory increase, this is primarily due to the operation of the Textile Code, rather than to the code of the textile machine builders themselves. Without the demand for textile machines largely created by the restriction of hours in the textile industry, the builders of textile machines would probably have continued to work less than the 40 hours a week allowed by their code. Few of them had been running as much as 40 hours during the past three years, and none was employing a full quota of men.

With the demand created by the Textile Code, however, textile machinery builders began receiving more satisfactory orders than for several years. Even without their own code more money would have been distributed as wages in their industry because of the increase in hours worked.

The great increase in orders from the textile mills, attributable to a desire for more modern equipment and to make up for the restriction in working hours, has been a boon to the builders of textile machinery. Adding to this the employment of more men to keep within the 40-hour limit, and the 35-cent per hour minimum of their code, we find the total of wage disbursement has materially increased. In most of the plants visited the increase in the number of men employed was given at over 100 per cent, some going as high as 150 per cent. The weekly wage per man has also been increased in nearly every case, even where the new rate only compensates for the reduction in hours per week, because there has been an increase in hours actually worked.

The week's work, under the old regime, varied from 44 to 50 hours in various shops. The five-day week, especially in summer, was not unknown before the code, and is now almost universal. Increases in wages, above the minimum, in most cases give the men at least as much for 40 hours as they previously received for the longer week. This is, however, a real increase in actual wages because few have worked 40 hours for several years.

Generally speaking, both men and management were pleased with the results obtained, a few managers even being quite enthusiastic. In one case the men rather grudgingly shared the work beyond 40 hours with others, when under the old dispensation they might have added ten more hours to their pay envelope. But with few exceptions the 40 hours and the new rate meant a larger income than before and many more men are employed. One manager, while admitting that the Textile Code had helped his industry by creating a demand for more machinery, would have been better satisfied if he and his men could have worked at the longer hours. The same type of men crop up in both the shop and the office.

One gets a strong sidelight on the situation by noticing that the textile mills ordered only the most efficient machinery to round out their equipment. This gave the machine builders who had improved their product a distinct advantage. Many of these new machines are so nearly special that one large builder carries no stock of machines but builds only to order. The same tendency was found to exist in the shops of the textile machine builders who had found it necessary to increase their own machine equipment. And these additions to the machine equipment have run into the hundreds of thousands of dollars in the plants visited. Nearly all had one or more "bottle-necks" in the production line that required excessive overtime. The machine purchases have balanced equipment and while some are still running two shifts in a few departments, this is not the rule. Some of the new equipment, incidentally, was for foundry improvement.

### Equipment Policy Unchanged

No changes in the equipment policy pursued were reported, the trend being to buy only machines of known efficiency to prevent congestion in certain departments and avoid overtime as much as posisble. Balancing of productive capacity is the main object in such purchases. These purchases have been the direct result of the two codes, which restrict hours to 40 per week and to two shifts instead of three. The cutting of production costs on single-shift operations has also been a factor. One shop reported such a large machine equipment that neither two shifts nor new machines were necessary. As this plant was working a large force full time, with a few overtime shifts, its statement must be taken at face value.

Quite different, however, was the situation in another shop, one of the oldest

ones among textile machine builders. This shop had received little if any benefit from the demands of textile mills for new equipment. While plants in neighboring towns were busy, this one had been on three days a week, or less, for months. Inquiry revealed that they had not brought their line of machines up to date and also that their machine equipment was decidedly antiquated. Builders of highly efficient metal-working machinery report that they have ceased trying to interest them in their product. No code can be expected to rejuvenate a plant with such management.

### Handling Two Shifts

The several shops running double shifts report various methods of handling the work under these conditions. Few men really like to work at night and efficient night work has always been a problem. Some, however, report no difficulty either as to production or quality. It is nevertheless the general practice to confine night work to the parts of machines rather than to let it extend to the assembly department. Hours of starting work vary. When no night work is done some shops start at 8 a.m., quitting at 4:30 p.m. In others the starting time is 7 a.m., stopping at 3:30.

In one plant the automatic machine departments work through from 7 a.m. to 3 p.m., the night shift coming on at 3 p.m. and working until 11 p.m. The men eat a lunch while the machines are running. This plan, proposed by the men themselves, gets a man home at about theater hours, and avoids working through the "wee small hours" after midnight, which are usually conceded to be trying both to men and to production.

Night shifts are handled in several ways. Foremen who have had to be demoted to the ranks, or laid off entirely during the depression, are being given a chance with the night shift. In other cases a few of the most experienced workers, or key men, are placed in charge of the night crew as working foremen, and paid a bonus as additional compensation.

In most shops the foremen, or key men, lap hours so that the retiring foreman can give the new man any information necessary regarding the condition of the work. Sometimes the day foreman stays beyond his quitting time; again the night man comes in a half hour ahead; or they may split the overtime between them.

Night work, however, affects less than 10 per cent of the men in most of the shops. About 200 men was the maximum number in the night shift observed. These men, as before stated, make machine parts to be assembled by the regular day force. With a greater increase in business, management will have to decide between a larger night force and an increase in machine equipment for day work.

In connection with the hours worked, one manager stated that the hours between 7 a.m. and 12 noon gave more and better production per hour than was obtainable in the afternoon. Both fatigue and the effect of the mid-day meal on the individual seem to enter into this picture. Another manager called attention to the increased care and maintenance necessary on machine tool equipment when used in double shift. Lubrication was given as the main point needing attention. This increase in maintenance cost, and the increased liability to delay from failures, is a factor in deciding on the installation of new machinery or the adding of a night force.

The most serious complaint of the hourly restrictions of the new Textile Machinery Code concerns the work of service men in the field. When something goes wrong in a customer's plant and a service man is called in to fix it so that production can be resumed, the customer is hardly to be blamed if he complains when the service man's time is restricted. Service men themselves have always been accustomed to staying on such a job until it was done, regardless of the time required. Sooner or later some means will have to be found to exempt such work from usual code restrictions. In certain other machinery codes this point has been satisfactorily covered.

The effect of the code on the efficiency or the morale of the men has been a live question. Such a question can be answered in several ways. Morale is increased with the knowledge of better business in the shop, and efficiency, according to some, is sure to improve when it is known that there is plenty of work ahead. Both efficiency and morale, however, depend largely on management, regardless of the code. Well managed plants report no noticeable change in either and do not anticipate any.

In no plant visited had there been a strike nor were any in the air so far as could be seen. No adjustment of differences by an NRA board was reported. Personnel relations seemed to be amicable in all respects. In one shop an employee relations plan or works council has been in operation for many years. So far, discussions have always been initiated by the management but the machinery is there, ready to function, if the new operating conditions incident to the New Deal call for its use.

## An Unsolved Explosion
## *Discussion*

S. A. SMITH

*Manager Gear Department, Meisel Press Mfg. Company.*

Referring to the article by William Anderson (*AM*—Vol. 77, page 596), there is hardly any probability that the mechanical equipment was the cause. The possibility that sparks from the commutator of the blower motor might have ignited the explosive mixture seems unlikely, as the commutator of the blower motor is on the opposite side from the air piping.

All gas valves should be so placed that the weight of the handle cannot move the valve in a direction that would open it. In other words, the stem of the valve should not project sidewise from the piping, but should be exactly on top of the piping. It would be desirable to have the gas and air valve handles operate and point in a uniform direction when they are open and shut, so the operator is never under any doubt.

It is just as important that the air valve be closed to prevent gas from backing into the blower piping. Therefore, both the gas and air valves should always be closed when the furnace is shut down.

The blowers, instead of the air piping, were destroyed because the air piping was of iron pipe instead of galvanized sheet iron, and too strong to burst, thus causing the blowers to burst. It is, therefore, desirable to use galvanized piping with soldered joints.

The operator, who started the equipment, was naturally considerably upset and may have been unable to give an accurate account of just what happened and exactly what procedure he followed in lighting the furnace.

In any case, the air valve of the furnace, on which the gas valve was found to be partially open, was also open. This must have been so for the gas to leak back into the air line. If it was the operator's practice to shut off only the gas at night, this is incorrect; both gas and air should be shut off. Otherwise, the entire air system would become filled or partially filled with a combustible mixture, which could ignite and flash back into the air piping when

a lighting torch was applied to any of the furnaces. Starting the blower might have the effect of forcing just enough mixture into the furnace to become ignited and flash back.

### Another Explanation

Another possibility is that the gas valve, if not quite closed when the furnace was shut down, might have permitted a raw gas flame to remain lighted at the burners within the furnace over night, while gas also leaked back the other way in the air piping. The gas going to the burners did not mix with sufficient air for combustion until it reached the inside of the furnace, and consequently, did not flash back into the air piping until the blower was started, at which time, an explosive mixture was forced to the burner, which immediately flashed back into the air piping. With air piping too strong to burst, the explosion occurred at the weakest point, which was the blower.

The spare blower line, also being filled with a combustible mixture, an explosion occurred on that blower in the same manner and for the same reason.

The fact that we mention the blowers as being the weakest point in this explosion, does not mean that the blowers were not of proper construction, but does mean that piping of light enough or weak enough construction between the blowers and the furnace, should be used, so the piping would blow out and not damage the more costly blower. Light gage galvanized piping, such as used in hot air furnace heating systems, would be in order, instead of iron pipe.

C. G. WILLIAMS
*Consulting Engineer*

There are two possible explanations for these explosions, using Mr. Anderson's statement that illuminating gas could have found its way into the casing of the blowers. First, the motion of the air against the vanes of the rotor and the casing of the blower may have generated static electricity in amounts greater than could be dissipated through connections. A spark, jumping from vane to casing, might have ignited the mixture of air and illuminating gas, causing the explosion. In times past, the writer has received appreciable shocks of electricity just by touching the casing of a blower and has repeatedly touched the casing to get further shocks without avail, until after some time had elapsed, when on several occasions much slighter shocks have been received.

Another possible explanation is that the explosive mixture of air and illuminating gas was ignited by another explosive mixture generated from the lubricant. Ofttimes when a point of thin film lubrication exists, as is natural when a machine is started up after being idle for hours, there is virtually metallic contact between the journal and the bearing. When in this condition, heat is generated faster than it can be carried away by the metal and reaches a point where a breakdown of a part of the lubricant occurs, forming explosive gases when mixed with air. When this happens, there will occur slight explosions of the gases thus generated, which would ignite the illuminating gas-air mixture.

It may be that enough gas could be generated by the breakdown of the lubricants to contaminate the air in the blower casing, even without the illuminating gas being present, to a point that an explosive mixture would be formed and this mixture became ignited by static electricity or by an explosive flame generated as the bearing became hot, though it did not become hot enough to sieze.

As we all know, there have been many explosions of air compressors that lubricating engineers now know were caused by this same phenomena.

## Are the Railroads Licked?
## *Discussion*

A. EYLES
*Manchester, England*

I am strongly in accord with the views expressed by the anonymous railway shop executive (*AM* — Vol. 76, page 929). Experience as a railroad shop foreman during the last 29 years leads me to state definitely that the British railroads are far from being "licked" despite the tremendous increase of freight and passenger road motor transportation in the past decade. This is the "age of speed" and its influence is being felt by every transportation concern in all countries. It is prompting our railroad mechanical engineers to higher efficiency and greater speed.

The railroad shops here are usually organized to build, recondition, and maintain their own rolling stock—but the product is not for sale. Nevertheless, the majority of English railroad shops have been reorganized for greater efficiency during the past few years. The reorganization of the London, Midland and Scottish Railway locomotive shops at Crewe, for dealing with locomotives under repair and generally for processing units is a good example. The belt or conveyor system has been employed, particularly on heavy repairs to locomotives. The original shops at Crewe had nine erecting departments with 256 engine pits. The new system has only 72 pits from which a larger output is secured. The time spent in a heavy overhaul has been reduced from 30 to 50 days to a maximum of 12 working days for the largest locomotives, and 8 days for small 0-6-0 engines.

### New Methods of Repair

A progressive system of passenger car repairing was also introduced by the same company in their Newton Heath shops. The principles behind the changes may be listed as follows: (1) the elimination of manual handling of materials as far as possible; (2) moving the job to the man, and not the man to the job; (3) allocating definite work to a given position; (4) supply of materials to be anticipated; (5) allocation of men to specified operations; (6) first operation to balance with the last; (7) all movements after definite intervals of time; (8) constant supply of passenger cars for repairs; and (9) good lighting, heating and comfortable working.

This progressive system differs from the previous repair method, as it enables work to be done on all sections of the cars simultaneously, thus lessening up the time the cars are in the shops. Under the progressive system of repairs the time taken for "general repairs" to bogie type cars is 25 working days, as compared with 59 days under the old practice. The passenger cars for "wash and varnish" now occupy 16 working days as compared with 37 days previously. Since the introduction of passenger car repairs on the progressive system at Newton Heath similar systems have been put in operation at the shops at Derby and Wolverton. At the latter place they are turning out 12-ton covered freight wagons at the rate of one every hour and three-quarters. In this time the various component parts are fabricated, cut, drilled, painted, and assembled, ready for service. Mass production of railway wagons has also been put in operation by the London, Midland and Scottish Railway Company at their Derby and Earlestown shops.

Another recent introduction by the British railroad companies is the all-steel containers which insures door-to-door transport of freight by road, rail and sea. Handling costs are greatly reduced. Risks of damage and pilferage are also reduced to a minimum. The railways are not going out of business. But efficiency in operation today is a matter of great importance, not only to the stockholders but to all classes of business enterprises served by the railroads. Efficient freight and passenger service rendered at reasonable cost is one of the essential conditions upon which the return of business prosperity depends.

# Cost-Finding To Assure Profits—IX

CHARLES H. HATCH
*Vice-president, Miller, Franklin & Company*

**Only through the use of reliable product costs can the cost of sales be determined with reasonable certainty. With the cost of sales determined accurately, it is practicable to compute dependable statements of operation and condition by cost periods without taking a physical inventory**

GENERALLY speaking, there are three types of product costs—job, estimate and unit. In some instances a combination of types may be used within a single concern.

The usual job cost is the result of gathering actual costs by lots or runs of product, regardless of whether or not the final figures are reasonable. Where such costs are used it is common practice to include the labor and material as actually reported and to use a pseudo-standard expense rate which is frequently varied as required to absorb the actually incurred expense. A job cost thus determined is historical and of little constructive use except for statement purposes. Although this type of product cost is antiquated, expensive to secure and uninformative or misleading, many companies still risk their success by its use.

Where costs cannot be gathered on a unit basis, unitization can be assimilated by using a comparative estimate basis. This basis is required by companies that manufacture to special design and order single units of product, non-repetitive products, miscellaneous repairs and the like where little or no standardization of product is possible.

Such costs rely on intelligent estimates rather than studied units as their standards. Against these estimates are gathered the actual costs by products. These comparisons indicate from a practical point of view the efficiencies or inefficiencies of operation. The reliability of such a method depends largely upon the ability of the estimating force.

Unit product costs, predetermined on a unitized basis for all elements of cost, are the most desirable. Fortunately, they are adaptable to the needs of the majority of metal-working plants, particularly those where there is reasonable repetition in the manufacturing processes. Because product costs established on a unit basis require no further calculation until units or unit values change, they produce more reliable results and require less work to maintain than any other type of product costs.

As there are many volumes available which describe the detailed procedures for job product costs and the comparative estimate basis, there is no use of discussing either of them further here. Since the majority of metal-working plants are interested in unit product costs, that is the method which we shall describe in detail.

The first step in the development of the unit product cost is to determine the part cost. It is not possible to design a part cost form which will answer the requirements of all cases, as such requirements vary widely according to both the type of production and the product being costed. However, Fig. 12 illustrates a type of part cost form which meets all of the usual requirements.

The initial information necessary to the intelligent costing of a part is usually obtained from the standards and production records. First, the part number, part name and date of costing are entered and the cost quantity determined and posted to the parts cost record. The cost quantity, which may be one, ten, one hundred, one thousand or other convenient multiple, is usually based on the economical production order quantity or production lot size. Thus cumbersome and minute fractions are avoided. The "cost per" is the quantity as used in subsequent steps of costing and is determined on the basis of the usual quantity used in later assemblies.

In Columns 1, 2, 3 and 6 are listed, from the standards and production records, the department numbers and departments in which the work is to be done, the operations to be performed and the labor and expense units required per cost quantity. In Columns 9 and 10 the material description and units required per cost quantity are entered. The unit values are entered from the cost records in Columns 4, 7 and 11. The parts cost form is then ready for calculation and completion.

In Columns 5, 8 and 12 the labor, expense and materials amounts are posted after calculation. These are the results of multiplying the units by the unit values. These columns are then totaled and in turn a cross total of the columns is made and posted in the total cost column (13). From this latter total column the "cost per" previously mentioned is calculated.

Column 13, total cost, is provided in order that costs of incompleted parts may be determined at the end of any operation for inventory and similar purposes.

There are instances where it is desired to maintain the cost of goods in process subdivided as to labor, expense and material. Admittedly such procedure requires an appreciable extension of detail. However, if it is warranted, the necessary space for such calculations has been provided in the last line. By dividing the totals of Columns 5, 8 and 12, respectively, by the appropriate quantity the "cost per" by cost elements may be obtained.

From the parts cost record, Fig. 12, all parts cost information for future use in costing the product is obtained. For this reason it is imperative that this record be continuously kept up to date.

## Repair Parts Cost

The parts cost record, as illustrated, usually suffices for costing into subassemblies and final product cost. When parts are sold as such for repair or other purposes, it may be desirable to provide on this record for the distribution cost. To do this it is only necessary to add to the parts cost record the distribution and total sold cost provisions as illustrated on the final product cost record, Fig. 13. The desirability of this latter treatment depends primarily upon the number of parts sold as such and also

upon the nature of the business as well as the type of product.

It is readily evident that the parts cost record is not a control instrument. It is merely a record of the predetermined cost or the reasonable expectancy cost of a product part. This is equally true of the subassembly and final product cost records. It will be recalled that any necessary corrections between actual and predetermined or unit values are made, at the source, at the time the profit and loss deviations by elements are determined.

There are numerous metal-working plants that manufacture only parts which are used by other manufacturers as purchased parts in the manufacture of their subassemblies and finished product. Again there are a great number of plants whose final products are subassemblies. This product in turn is used by other manufacturers as purchased parts in further subassemblies or their final product. Still other plants manufacture their own parts, subassemblies and final product as they go to the consumer.

It can be readily seen that in the first instance the part cost will be the final product cost as well, and in the second instance the subassembly cost will also be the final product cost.

Also in many instances one subassembly becomes a part of another subassembly, which in turn goes to make up another. In the first two stages it may be only necessary to calculate the manufactured cost of such subassemblies. If the subassembly is sold in the third stage the total sold cost for the third subassembly would have to be calculated to include the distribution cost.

Thus it is not practical to attempt to define the limitations of a subassembly cost record for the metal-working industry as a whole. The scope of the subassembly cost record will depend largely on the individual business.

There is so close an interrelation between subassembly and final product cost records that in most instances either record may serve either purpose equally as well.

Fig. 13 illustrates the final product cost record. With modification such as the name of the record and the change of "model number" to "subassembly number" such records will meet the requirements of subassembly costing. In that the technique and development of both records is practically identical the two records will be explained simultaneously.

The final product cost record illustrated includes all the usual requirements to determine the final unit product cost. Of course, modifications of this form should be made in individual cases to meet peculiar needs. For example, where a considerable number of subassemblies and parts are used in the final assembly, it is common practice to use the front of the form for recording such material costs and the back of the form for the assembly and distribution costs, carrying over the costs from the front to the back of the form. There are instances where the assembly costs predominate. In such cases the front of the form is devoted to building up the assembly cost and the back of the form to the development of the subassembly and parts materials and distribution costs.

PART COST

PART NO. _____ DATE _____
PART NAME _____ COST QUANTITY _____
COST PER _____

| DEPT. NO. | DEPARTMENT & OPERATION | LABOR | | | EXPENSE | | | MATERIALS | | | | TOTAL COST |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | UNITS | UNIT VALUE | AMOUNT | UNITS | UNIT VALUE | AMOUNT | DESCRIPTION | UNITS | UNIT VALUE | AMOUNT | |
| | | | | | | | | | | | | |
| | TOTAL MANUFACTURING | | | | | | | | | | | |
| | TOTAL MFG. COST PER _____ | | | | | | | | | | | |
| ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | ⑧ | ⑨ | ⑩ | ⑪ | ⑫ | ⑬ |

**Fig. 12—A completed part cost form should be kept on file for each part manufactured as computed on a current basis. All those calculated on any other basis should be kept in the obsolete, inactive or estimate file, according to their classification**

## Current Records Filed

As in the case of the parts cost record, there should be on file a completed subassembly and final product cost record for each product manufactured. The active file should contain only those costs which have been completed on the current basis of calculation, while those calculated on any other basis should be kept in an obsolete, inactive or estimate file.

The basic information necessary to the intelligent costing of fabricated products—subassemblies and final products—is usually obtained from the standards and production records.

First, the subassembly, or final product, number and name, date of costing and the cost quantity are entered on the proper cost record. The "cost per" quantity, as determined for subsequent usage, is then entered.

In Columns 9 and 10 in the first division of the material section are entered the subassemblies and parts and number of each to be used in the product to be fabricated as defined by the standards and production records.

In the assembly section—Columns 1, 2, 3 and 6—are listed from the standards and production records the department numbers and departments in which the work is to be assembled, the operations to be performed and the labor and expense units required per cost quantity. In Columns 9 and 10 are entered the assembly material description and units required per cost quantity.

Where fabricated products are sold as such, the distribution expense units per cost quantity are entered in the distribution section, Column 6, from the cost records, according to the sales classification of the product.

For all divisions in Columns 4, 7 and 11, the item and unit values are entered from the cost records. The cost form for the fabricated product is then ready for calculation and completion.

In Columns 5, 8 and 12, the labor, expense and materials amounts are posted after calculation. These are the result of multiplying the items by the item values and the units by the unit values. These columns are then sub-totaled and totaled and in turn cross totals of the columns are made and posted in the total cost column (13). From these latter totals the "cost per" previously mentioned is calculated and entered.

The form illustrated provides in the first section for the bringing forward of subassembly and parts costs by cost elements if desired. If they are not de-

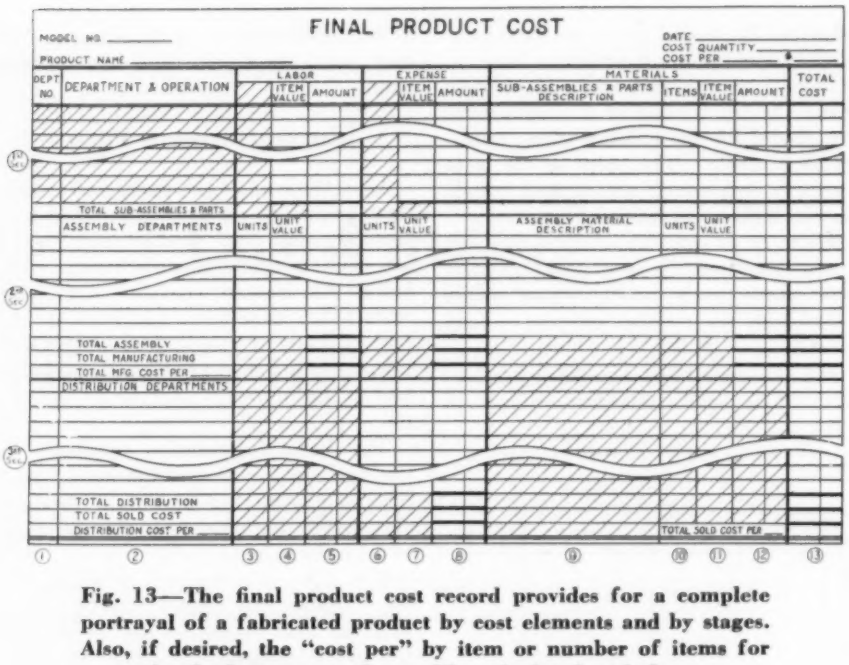


**Fig. 13—The final product cost record provides for a complete portrayal of a fabricated product by cost elements and by stages. Also, if desired, the "cost per" by item or number of items for the final stages can be readily calculated and shown**

sired, the subassemblies and parts costs rightfully included in the first section can be included in the materials division of the first section and treated in total value per item as though they were purchased parts.

Column 13, total cost, is provided in order that costs of incompleted fabricated products may be determined at the end of any stage of completion for inventory or similar purposes.

The final cost records for fabricated products that are sold serve two important purposes: (1) for comparison with selling price and (2) for use in developing the cost of goods sold for a cost period.

### Price Policies

It is obvious that any sound sales and price policy is dependent not only upon reliable cost information but upon the current perusal of such information as well. However, too many executives try to formulate important policies by reviewing the individual cost records, thus losing their perspective. True enough, in critical pricing situations the individual product costs are vitally necessary in solving the problem. But for general use the coordinated results of product costs and product sales by *studied classification* are the correct foundation for arriving at major policy decisions. They are indispensable for regular comparative purposes.

The routine development of the cost of sales for cost period statement purposes is, of course, important. It is of more importance, however, properly to subdivide and classify the cost of sales, including the sales figures. Only so will the figures provide useful comparisons of merchandise profits and losses for use in determining policies and enable the management intelligently to concentrate sales energies along profitable lines.

## Experiences in Machining Aluminum Alloys

### *Corrections*

The slugs, Fig. 1 (*AM*—Vol. 77, page 645), were bandsawed, not hand sawed. On page 688 (second installment), first column, sixteenth line, the sentence should read "Taps ⅜—24 S.A.E. have repeatedly cut within 0.0006 in. of their own pitch diameter in dural." Tapping to 0.0006 in. in such material is an accomplishment, and the author states that it was made possible by using a helical-fluted tap, ground all over.

## Reference Temperature for Limit Gages

One important element to be standardized when a national standard system of fits and limit gages is established is the reference temperature of the gages. In the United States, 68 deg. F. has been adopted as a national standard and is generally used by gage manufacturers. The same temperature has also been proposed or adopted as a national standard in the following countries: Austria, Belgium, Czechoslovakia, Denmark, Finland, France, Germany, Great Britain, Holland, Hungary, Italy, Japan, Norway, Poland, Russia, Sweden and Switzerland.

Until recently, there were but two exceptions to the adoption of the 68 deg. temperature by industrial countries. One was in Great Britain, where 62 deg. F. was in use because it is the temperature at which the British Imperial Yard is defined. The other was France, which used the reference temperature of 0 deg. C. (32 deg. F.), the temperature at which the meter is defined.

When international cooperation in the standardization of tolerances for fits and limit gaging was started some years ago under the procedure of the International Standards Association (ISA), this brought up the question of unifying the reference temperature for gages internationally, if possible. French industry agreed to adopt the reference temperature of 68 deg. F. for limit gages and industrial measuring instruments on condition that it actually be adopted in an international way. British industry was canvassed by the British Standards Institution (then still called the British Engineering Standards Association) as to whether it would not also adopt the 68 degree temperature for the sake of international uniformity. The reply to this canvass has been in the affirmative. This result is no doubt also due to the fact that the reference temperature of 68 deg. F. has been adopted for gages by the International Committee on Weights and Measures. Following the decision of the latter body, the National Physical Laboratory (which in Great Britain plays a role similar to that of the Bureau of Standards in the United States) has, since Jan. 1, 1932, given all measurements of engineers' gages, micrometers, and similar objects at the temperature of 68 deg. F., instead of 62, unless definitely requested to do otherwise.

The difference between two steel gage blocks of the same nominal size made to the reference temperatures 68 and 62 deg. F. is relatively small. In fact, the difference between two such blocks with a nominal length of one inch is about 38-millionths of an inch when they have the same temperature. This difference would compare to a difference of less than 0.6 inch on the height of the Empire State Building in New York (1250 feet). However, in spite of the relative smallness of its effect, the influence temperature must be given due consideration in many cases where parts are to be held between close limits. Thus, for example, the gaging of precision parts is being now carried out in some plants in a room where the temperature is kept constant at 68 deg. F.

# EDITORIALS

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EDITORS

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## Men of Good Faith

A new Who's Who of the real leaders of industry could be compiled by listing the men who make up the Code Authorities set up under NIRA. Few readers of *American Machinist* will know personally or by reputation many of these men. But they will know the men elected to the Code Authority of their own industry, and from them they can judge the character of the rest.

The cynics, the reactionaries and the rabid reformers will say that the men on the Code Authorities cannot be trusted, that they are only human and that they will wink at minor infractions of the Codes. That it will be only a short time before all the old corner-cutting practices are once more in evidence and another splendid ideal has fallen.

We differ. We believe that industrial executives recognize in NIRA the opportunity to conduct their affairs as they have always wanted to, unaffected by the wage chiseler. We accept at its face value such a resolution as this one just adopted by the Code Authority of the American Gear Manufacturers' Association:

"Resolved that it shall be the policy of the Code Authority to cooperate with the Administrator in the administration of this Code to the best interests of the industry and its employees, and to that end the members of the Code Authority hereby pledge themselves to carry out the provisions of this Code without fear of or favor to any individual interest."

The men on the Code Authorities are men of good faith, and the members of their industries will welcome the chance to follow their leadership.

## Management's Greatest Asset—Personnel

Management, as we have frequently pointed out, is being confronted with new and serious problems. One of the most important is that of personnel relations, which has received scant attention since labor ceased to find ready employment.

Congress has given labor the legal right to organize and to select its own representatives. But we should remember that it is not compelled to do so, as many seem to think. Instead of wasting time bemoaning the passing of the so-called "open shop," which was usually open to non-union men only, management should grasp the opportunity of cultivating personnel relations on a sound basis, that of fair dealing which begets mutual good will.

Men in shops where good personnel relations prevail are not anxious to organize. There have always been plants in strongly unionized districts in which labor leaders never got a foothold, because of the excellent relations between men and management. Such shops frequently secure exceptional economy in production by reason of the cooperation arising from enthusiasm and good will. In some cases this has offset better machine equipment in plants lacking these assets.

A proper personnel policy does not mean coddling or giving up of real managerial functions. Few shopmen desire to interfere with matters that do not directly affect their welfare. They do not wish to assume the responsibilities of management. They do like to be considered as human beings and not as "one of the help," and to be consulted on certain subjects. They like to know interesting details about the work and where it is going.

The new laws give management opportunities never before presented. The chiseler on hours, wages and prices no longer holds the whip over forward-looking management. Open-mindedness is the order of the day. Unreasonableness on either side cannot be allowed to delay the return of better business. Management, to whom we naturally look for the best leadership, must live up to its responsibility.

## Broad-Minded Managers

One of the encouraging signs of the times is the broad way in which leaders of industry view the changing conditions. The remarks of Walter C. Teagle, president of the Standard Oil Company of New Jersey, before the Academy of Political Science recently, show a liberality of view that is highly commendable.

"If business is to run itself, as contemplated in the act, then business men must take the initiative in regulating their own affairs, to the end that interference by government may be restrained to a minimum. We must not oppose change merely because it inconveniences us. I am convinced that Washington does not want to run private business. It cannot favor measures that would destroy individual initiative and standardize all producers.

"It is apparent that President Roosevelt is feeling his way by trial and error to a more equitable distribution of the national income, and more power to him! It is the one ultimate insurance of human welfare and community prosperity.

"We must bear in mind that all workers did not share in the success of industry in the good years. The American Federation of Labor cannot be blamed for

increasing its membership. As an employer, I believe that management has been wrong as often as labor in precipitating strikes and lockouts. A proper concern for the rights of workers and the maintenance of some form of contact through which they could bring their problems to management would have been in most cases the means of keeping these disputes from reaching such formidable proportions."

We are indeed fortunate in having men of this caliber in industry. We need more managers who can consider problems in such a fair manner.

## Measuring Surface Quality

Quality, as applied to surface, has been one of the most indefinite terms in engineering. The present considerations are accuracy, smoothness, and appearance. Accuracy of dimensions and smoothness to present the greatest area of actual contact are more important in the operation of machinery than appearance. A lapped surface is frequently less pleasing to the untrained eye than a high polish, but it makes a much better bearing. Accurate measuring of surface quality, or even reliable comparison with a surface that has proved satisfactory, is as yet an unsolved problem.

From the production standpoint comparative methods are all that is necessary. Given a means of duplicating a surface known to be satisfactory, both the production man and the inspector will be satisfied. But it must be a method that can be used in the shop just as the thread or gear tooth comparator is used. It can be a visual limit gage rather than a micrometer.

The field is practically wide open to those of inventive mind. Suggestions range from reflected light to sound produced by metals in contact. A simple, practical method is badly needed.

## • CHIPS •

**Washington**—Peek leaves AAA to keep peace in the family and to promote agricultural exports . . . 300 AAA codes go over to NRA . . . New council set up to coordinate recovery agencies . . . Financed by Spelman Fund, Social Science Research Council will study all government jobs, Federal, State and local . . . Roosevelt studies Federal budget of $2,600,000,000 for regular expenses and an equal sum for relief and public works . . . Trying to steer a middle course between conservatives who would spend nothing and liberals who would spend $10,000,000,000 . . . Announces receipt of a report from committee headed by Secretary Roper proposing unification under government regulation of all communication facilities . . . Automobile industry asks continuance of code for 8 months, Johnson approves, merit clause remains.

**Foreign**—Spanish reds revolt, wreck train, kill over 100 . . . Chinese government arranges with Curtiss Aeroplane & Motor Co. to build plane plant in China . . . Fascist Grand Council passes law emasculating Chamber of Deputies . . . National planning legislation in England likely in January . . . Similar action possible in France . . . Vice-Chancellor von Papen's "Germania" directs Germans abroad to cease advertising in unfriendly foreign newspapers . . . Litvinoff passes through Berlin without diplomatic visit despite Nazi overtures . . . Coalition government likely in England . . . Ship subsidy considered . . . Work on giant Cunarder resumed.

**Finance**—Gold price information leak bothers Treasury officials . . . Decline in commodity price level wipes out gains that followed inauguration of gold purchase policy . . . Senate and House committees open joint hearing on tax legislation . . . Atchison pays surprise preferred dividend of $3.30 . . . National City Bank of N. Y. reduces common stock by $46,500,000, sells $50,000,000 preferred to R.F.C. . . . Burlington resumes dividends . . . $950,000,000 Treasury loan oversubscribed three times . . . British decline to enter stabilization agreement with U. S.

**Industry**—PWA loans $36,000,000 to four roads to buy locomotives and cars . . . P. S. du Pont elected chairman of Industrial Advisory Board . . . New Ford introduced at New York industrial exhibit, changes mostly mechanical . . . New Plymouth to have individual front wheel suspension . . . Budd Mfg. and Weirton Steel defy Labor Board rulings on elections . . . Lehigh Valley and New Haven get PWA work loans to increase shop operations . . . P.R.R. orders 100,000 tons of rails from four steel companies . . . N. Y. Central and P.R.R. to cool more cars . . . E. R. Stettinius, Jr., resigns NRA post and General Motors positions to become vice-chairman of U. S. Steel finance committee . . . General Johnson appoints government representatives on 90 Code Authorities.

**Trade**—November retail trade 3 per cent under 1932 . . . Studebaker sales in November best in 8 years . . . Pullman report shows gain in railroad passenger traffic for October . . . Department store sales up 2 per cent in November . . . Rumored that Mack Trucks, Inc., will distribute Ford trucks also . . . Wholesale commodity prices rise slightly, now 12.5 per cent above last year's figure . . . Wholesale food prices down a bit . . . Christmas trade ahead of last year.

**Indicators**—Electrical power production resumes upward trend halted several weeks ago with 6.6 per cent advance over corresponding 1932 week . . . Business Week's index of business activity holds gain and is now at 62.3 . . . Iron & Steel Institute reports steel activity up to 34.2 . . . Carloadings 17,000 above last year.

# Johnson Predicts Still Shorter Work Week

In an address on December 7, in New York City, before the annual meeting of the National Association of Manufacturers, General Hugh S. Johnson, National Recovery Administrator, stated that a still shorter work week was in prospect. He added, however, that studies made by the NRA showed a flat 30-hour week now would prove ruinous. "We must balance the dreadful necessity of employment to the capacity of industry—depending on its business—to absorb it."

General Johnson frankly discussed organized labor and the fear of many industrial leaders that its power would be abused under the Recovery Act. He emphasized that whereas NRA had a direct mandate to foster the organization of industry, all that labor has, is a right to organize if it so desires.

Turning to the much discussed merit clause, General Johnson quoted President Roosevelt's letter of October 19 (*AM*—Vol. 77, page 711), and explained it saying, "It means that pretending an open shop you cannot hire a man and then, discovering that he has a union card in his pocket, fire him for dropping a monkey wrench." Industry was warned against violent reactionary propaganda, such as occurred last spring, because of its certainty to have an effect opposite to that intended.

In an address at the afternoon session, Dr. Wilfred I. King, Professor of Economics, New York University, assailed the NRA and advocated a laissez-faire policy instead of "managed industry." He contended that the older order of industry was being replaced because of a depression for which it was not responsible. George L. Markland, president of the Philadelphia Gear Works, in discussing Dr. King's address, protested against high government expenditures and expressed his doubt of the benefits of NRA.

In an address at the same session, Robert L. Lund, president of the Association, criticized the situation that had arisen as the result of the enforcement of industrial codes. He claimed the act was a labor law rather than a recovery law. James A. Emery, general counsel of the Association, gave a luncheon address on "The Manufacturer and National Recovery."

At the luncheon meeting on December 8, Frank W. Vanderlip, former president of the National City Bank, defended the President's policies, while Dr. Ray B. Westerfield, professor of economics, Yale University, attacked them.

At the evening session, Representative Joseph B. Shannon, of Missouri, described his efforts to take government out of competition with private industries. Other speakers on the two-day program were Arthur L. Faubel, secretary, American Tariff League, Charles E. Stuart, former adviser to the Russian Soviet Government, Dr. Virgil Jordan, president of the National Industrial Conference Board, and Martin W. Littleton.

## Tool, Die & Machine Shops Select Code Authority

Upon approval of the code of fair competition, sponsored by the Special Tool Die and Machine Shop Institute, a code authority was appointed, composed of the following: J. J. Kohl, president of the institute and president of the International Tool Co.; F. S. Blackall, Jr., president of Taft Pierce Mfg. Co.; C. C. Richard, Allied Products Co.; H. A. Stoddard, president of Interstate Laboratories, and Roy T. Wise, managing director of the Institute. Local divisions of the institute are appointing committees to cooperate with the code authority in the enforcement of code provisions and the policing of the industry. Trustees of the institute will meet in Cleveland on February 4 and the annual meeting will be held on the day following.

## Norton Exhibits New Products

Grinding machines embodying the latest developments of the Norton Co. were shown at an exhibition and sales conference held December 4 to 8 in Worcester, Mass.

Particlarly interesting were the demonstrations of the "Nortonizer" or automatic sizing caliper used on plunge-cut cylindrical work. This rests on the work until it is reduced to the predetermined diameter when it automatically lifts out of the way. All gaging is done directly from the work itself and size is not affected by truing the wheel.

The exhibit was carefully planned to show the advances made in design and construction. Units of different kinds can be assembled on and in standard machine bases. Hydraulic feeds can be substituted for hand or machine feeds when desired.

A new tool grinder, cam grinders and lapping machines attracted attention. Those who recall early grinding operations and the results obtained were especially impressed with the advances made in both accuracy and finish.

## • INDUSTRIAL REVIEW •

**As the year draws to a close domestic business in machinery and machine tools is dropping off seasonally. Foreign business, on the other hand, has been stimulated considerably by the fall in the dollar. According to the National Machine Tool Builders' Association, export sales in November were 40 per cent of a total that set a high record for nearly 30 months. 1933 as a whole was much better than anyone expected during the trying period of the first half, but not as good as had been hoped for during the summer pick-up.**

**Reports from the Atlantic seaboard vary. In general there has been a distinct slowing up in December, but one dealer organization at least has found the month highly satisfactory. In Pittsburgh much the same situation exists. The year's business was ahead of that of 1932 and a few companies found December better than preceding months. Reports from Cleveland indicate a falling off in the last two months of the year. The strong rise of September and October was not continued. In Detroit, however, the picture is brighter. As the shows approach, automobile manufacturers are stepping up production and supply business is rising proportionately. Orders for machine tools are being placed in small volume and inquiries are more promising. The Citroen purchasing committee has placed some orders, mostly special.**

**December business in Cincinnati will be better than that of December, 1932. Sentiment is generally improved, probably because of fairly satisfactory orders placed, partly from government sources, partly from abroad. In St. Louis November was the peak month for the machinery men. December is off appreciably. Chicago reports 1933 as being far ahead of 1932 but not what had been hoped for. Business in December has been disappointing but inquiries are encouraging. Milwaukee reports essentially the same situation with December dull.**

# Dr. Potter Tells Engineers To Widen Activites

At the annual meeting of the American Society of Mechanical Engineers, Dr. A. A. Potter, dean of engineering, Purdue University, and outgoing president of the society, urged engineers to take a greater interest in social and economic questions. Dr. Potter stated that, since the engineer had developed means for creating wealth, he could no longer afford to stand aside and let financiers, promoters and politicians bungle the problems of its distribution.

On the morning of September 7, Dr. Virgil Jordan, president of the National Industrial Conference Board, criticised current steps toward industrial recovery as being unsound. Business leaders, said Dr. Jordan, are submitting to the regimentation of industry for temporary competitive gains without fully understanding the collectivist implication of administration policies. He blamed the war for what he termed spiritual sterility here and abroad which has eclipsed the spirit of individual enterprise.

Credit inflation was advocated in another session, by David Cushman Coyle, consulting engineer, who delivered the annual Henry Robinson Towne lecture. Mr. Coyle also advocated higher income taxes, non-self-liquidating public works, government control of transportation and power, and decentralization of private industries, in order to bring about a new economic order.

Election of officers for the coming year was announced during the meeting. The new president is Colonel Paul Doty, chairman of the Minnesota State Board of Registration for Architects, Engineers and Surveyors. Vice-presidents are, H. L. Doolittle, designing engineer, Southern California Edison Co.; W. L. Batt, president, S.K.F. Industries, Inc.; E. C. Hutchinson, president, Edge Moor Iron Co., and E. H. Whitlock, professor of mechanical engineering, Stevens Institute of Technology. New managers of the society are J. M. Todd, consulting engineer, E. L. Ohle, professor of mechanical engineering, Washington University, and J. A. Hall, professor of mechanical engineering, Brown University.

Ambrose Swasey, past president and honorary member of the society, was awarded the A.S.M.E. medal for 1933 for his contributions to the advancement of the engineering profession. The Worcester Reed Warner Medal went to Dexter S. Kimball, dean of engineering, Cornell University. W. E. Caldwell, United Electric Light and Power Co., was honored with the Melville Medal for 1933 for his papers on "Characteristics of Large Hellgate Direct Fired Boiler Units."

## John Ripley Freeman Honored Posthumously

The John Fritz medal for 1934, the highest honor bestowed by the engineers of America, was awarded to John Ripley Freeman, past president and honorary member of both the American Society of Civil Engineers and the American Society of Mechanical Engineers. Because of the death of the medallist, the presentation will be made to one of his sons, John Ripley Freeman, Jr. The ceremony will take place on January 17, at the time of the annual meeting of the American Society of Civil Engineers, in the Engineering Auditorium, New York City.

## PWA Allots Funds for Railway Reconditioning

Railway equipment loans totalling $41,807,500 have been authorized by the Public Works Administration, subject to the negotiation of satisfactory contracts. Allotments of $18,065,000 to the Chesapeake & Ohio, $11,964,000 to the Erie, $5,028,000 to the Nickel Plate and $1,250,000 to the Northern Pacific will be used for the purchase of 12,775 freight cars, 167 passenger cars and 30 locomotives. The Northern Pacific has received bids, the Erie and Nickel Plate have requested bids, and the C. & O. will do so soon. Allotments made for railway equipment are contingent upon a showing of reasonable promptness by the applicants in completing their contracts with the administration.

Repairing and rebuilding cars and other equipment by the New York, New Haven and Hartford Railroad and the Lehigh Valley Railroad will be made possible by a loan allotment of $5,500,000. These companies will be enabled to put 2,700 men to work in their shops, and it is estimated that at least twice as much indirect industrial employment will result. About 700 men will be employed in the Readville, Mass., and Van Nest, N. Y., shops of the New Haven, to rebuild and improve passenger and freight cars and electrical equipment. Approximately $1,150,000 out of the $3,500,000 allotted to the New Haven will go for labor.

Lehigh Valley's present schedule of operation in its Sayre and Packerton, Pa., shops will be increased from two days per week to five or six days per week. Of the $2,000,000 allotted the Lehigh Valley with which to rebuild 2,600 box and coal cars, $900,000 will be spent for labor.

According to the applications of these roads for funds, the New Haven will spend $2,300,000 of its allotment by June 15 next, while the Lehigh Valley will have spent its entire allotment by that date.

## Hughes Employees Reject Outside Representation

Based on a complaint to the National Labor Board, by the International Association of Machinists, that the Hughes Tool Co. was discharging men for joining the Machinists' Union, it was decided to hold an election of representatives for collective bargaining supervised by the board. John D. Moore, technical adviser to the board, was sent to supervise the election which took place on December 2. A telegram which reported the results of the election read as follows: "American Federation of Labor representation was rejected thousand to six hundred with both sides cheerfully accepting the results."

## Higher Duties Asked in the United Kingdom

According to an announcement by the United Kingdom Import Duty Advisory Committee, applications have been received for increased duty on tools, excepting forks, shovels, spades, scythes, sickles, agricultural implements, screw taps and dies with ground threads and pressure-type blow lamps for liquid fuel. The request includes domestic tools but not machine tools other than separable cutting, drilling, screwing, milling, forming and holding parts used in machinery and machine tools and parts thereof.

## Date Set for Leipzig Fair

Twenty-two countries will send 7,000 exhibits to the Leipzig Spring Fair to be held in 1934, March 4 to 11. This will be three times as large as any prewar fair. Those contemplating visiting the fair can obtain full information from the headquarters in this country at 10 East 40 St., New York, N. Y.

ROLLAND J. HAMILTON

## Industry Board Chairmanship Goes to Du Pont

Succeeding Louis E. Kirstein, Pierre S. Du Pont, chairman of the board E. I. Du Pont de Nemours & Co., was recently elected chairman of the Industrial Advisory Board for the Department of Commerce.

At the same time five new members of the Board were inducted into office. These are: A. Lincoln Filene, chairman of the board, William Filene's Sons; William A. Harriman, chairman, Union Pacific Railroad Co.; William T. Kemper, Chairman of the Board, National Bank of Commerce, Kansas City, Mo.; Morris E. Leeds, president, Leeds & Northrup; and Thomas L. McNinery, president, National Dairy Products Corporation.

Rolland J. Hamilton, president of the American Radiator & Standard Sanitary Co., was elected by the board as its representative on the Code Authority Organization Committee recently appointed by the President (*AM*—Vol. 77, page 788e).

## Compton Heads NRA Trade Association Division

In a speech before the National Association of Manufacturers, General Johnson announced the appointment of Dr. Wilson Compton, recently resident industrial advisor of NRA and best known as director of the National Association of Lumbermen, as chief of the Trade Association Division. This post until recently was held by General Thomas S. Hammond, former president of the Illinois Manufacturers Association. The appointment is General Johnson's answer to the demand that trade associations be given a rightful place in the NRA picture.

# Hearing Scheduled for Forty Machinery Codes

Action on the NRA policy of grouping codes was heralded in an announcement by Deputy Administrator H. O. King that a hearing on 40 capital goods codes will be held in the Department of Commere Auditorium at 10 a.m., December 21. The codes included are all sponsored by associations affiliated with the Machinery and Allied Products Institute. Twenty-seven of them are coming up for first public hearing, while thirteen have already been through a hearing, but are to be reconsidered in the general grouping.

A statement by Divisional Administrator Malcolm Muir explained the reason for this move. Mr. Muir stated in part, "This method of holding public hearings is not to be construed as an attempt on the part of NRA to 'rush' hearings, but rather as a plan to expedite the regular procedure. In this case the clauses which are common to all of the codes will be considered first. Following this each clause in each code will be considered separately in the manner which has been generally followed."

At this hearing codes for the following industries will be heard for the first time: bakery equipment, sprocket chain, locomotives, railway and industrial springs, steel tires, wire machinery, hair clippers, oil field pumping engines, jacks, envelope machines, mechanical lubrication, rolling mill machinery, chemical engineering equipment, power transmission equipment, contractors' pumps, casters and floor trucks, diamond core drills, roller and silent chains, water softeners and filters, reduction machinery, concrete mixers, air filters, refrigerating machinery, hydraulic machinery, waterpower equipment, railway appliances, small locomotives.

The following codes are being reopened for inclusion in the general hearing: beater, jordan and allied equipment, cereal machinery, conveyor and material preparation equipment, diesel engines, hoists, hoisting engines, kilns, coolers and dryers, pulverizing machinery and equipment, rock and ore crushers, saw mill machinery, steam engines, water meters and woodworking machinery.

## Metal-Working Code Hearings Scheduled

| Date | Place | Deputy Administrator | Association |
|---|---|---|---|
| Dec. 20 | Willard Hotel | W. A. Janssen | Filing Supply Manufacturers. Safe Manufacturers |
| Dec. 20 | Willard Hotel | W. A. Janssen | Business Furniture Equipment & Filing Supply (Modification) |
| Dec. 20 | Willard Hotel | Malcolm Muir | National Association of Bottling Machinery Manufacturers |
| Dec. 20 | Washington Hotel | K. J. Ammerman | Aero Chamber of Commerce |
| Dec. 20 | Harrington Hotel | H. O. King | Manufacturers of Chilled Car Wheels |
| Dec. 20 | Carlton Hotel | H. O. King | American Die Casting Institute |
| Dec. 20 | Willard Hotel | H. O. King | Institute of Wrench Manufacturers |
| Dec. 20 | Willard Hotel | H. O. King | Porcelain Enamel Institute |
| Dec. 20 | Willard Hotel | H. O. King | Shoe Shank Manufacturers |
| Dec. 20 | Willard Hotel | H. O. King | Hack Saw Manufacturers |
| Dec. 20 | Willard Hotel | H. O. King | Power and Gang Lawn Mower Manufacturers |
| Dec. 21 | Commerce Auditorium | H. O. King | MAPI Codes for 40 machinery groups |
| Dec. 21 | Commerce Bldg. | H. O. King | Allied Manufacturers of the Beauty and Barber Shop Industry |
| Dec. 22 | Washington Hotel | W. A. Janssen | Lead Industries |
| Dec. 27 | Willard Hotel | Malcolm Muir | Newspaper Printing Press Builders |
| Dec. 28 | Willard Hotel | Malcolm Muir | Wire, Rod and Tube Die Manufacturers |
| Jan. 4 | Commerce Auditorium | H. O. King | National Electrical Manufacturers (modification) |

## Price Hearing Postponed

Because no properly authenticated evidence of unwarranted price increases has been filed, General Johnson announced that the public hearing on price increases, originally scheduled for December 12 (*AM*—Vol. 77, page 756b), has been postponed until January 9. General Johnson took this opportunity to caution industry and trade generally that price agreements not "expressly sanctioned by an approved code" are a violation of the anti-trust laws.

## Joint Authority Set Up by Container Machinery Manufactures

To put into effect the code of fair competition for the Packaging Machinery Industry and the Canning and Packing Machinery Industry, approved on October 31 and November 1 respectively, a joint code control committee has been set up as the agency of the code authorities for these two groups. Ogden S. Sells, vice-president, Food Machinery Corporation, is chairman of the joint committee. H. H. Leonard, vice-president and general manager, Consolidated Packaging Machinery Corporation, is vice-chairman and W. J. Donald is executive secretary and treasurer.

## Johnson Nominated for A.I.E.E. President

To fill the offices becoming vacant August 1, 1934, the nominating committee of the American Institute of Electrical Engineering has selected the following candidates: president, J. Allen Johnson, chief electrical engineer, Buffalo, Niagara and Eastern Power Corporation; vice-presidents, W. H. Timble, professor of Electrical Engineering and Industrial Practice, Massachusetts Institute of Technology; R. H. Tapscott, vice-president, New York Edison Co.; G. G. Post, vice-president, Milwaukee Electric Railway & Light Co.; F. J. Meyer, vice-president in charge of operation, Oklahoma Gas & Electric Co.; F. O. McMillan, research professor of electrical engineering, Oregon State College. Directors: F. Malcolm Farmer, vice-president and chief engineer, Electrical Testing Laboratories; Nevin E. Funk, vice-president in charge of engineering, Philadelphia Electric Co.; H. B. Gear, assistant to the vice-president, Commonwealth Edison Co. National treasurer; W. I. Slichter, professor of electrical engineering, Columbia University.

The Edison medal for 1933 was awarded to Dr. Arthur E. Kennelly, professor emeritus of electrical engineering, Harvard University.

## Used Machinery Dealers Organize

As a result of many meetings, local and national, the National Association of Used Machinery and Equipment Dealers was formed in Pittsburgh at a meeting held on December 9. This is a voluntary association of dealers. Officers are M. D. Galbreath, president; Samuel A. deWitt, vice-president; and C. L. McDonald, treasurer. By-laws have been adopted and a code prepared which will be submitted to Washington shortly. Used machine tool dealers are represented on the board of directors by Louis E. Emerman.

## Industrial Credit Needed, Says Bliss

In an article, entitled "New Machines Needed to Create Profits Under the New Deal," Philip E. Bliss, president of the Warner & Swasey Co., states that frozen industrial loans will be more quickly liquidated if bankers extend borrowers additional credit for the purchase of modern equipment and machinery. To liquidate its loan industry must cut production costs, which necessitates the purchase of machine tools.

To emphasize this point Mr. Bliss tells of a company in which the equipment for one important operation is obsolete. "Replacement by new and more efficient machines would cost $75,000. The saving effected in operating costs would amount approximately to $42,000 a year. The new machine tools would, therefore, pay for themselves in a little over eighteen months. Net earnings over a period of time would be substantially improved. It would appear obvious, under those circumstances, that this $75,000 expenditure was advisable —even if it had to be made with borrowed money."

## Billings Becomes President of Exhibitors Committee

At the annual meeting of the Board of Directors of the Exhibitors Committee the following officers were elected for 1934: president, E. J. Billings, The Babcock & Wilcox Co.; vice-president, L. W. Shugg, General Electric Co.; secretary, F. C. Kerns, The Texas Co.; Treasurer, J. P. Ferguson, Reading-Pratt & Cady Co.; executive secretary, W. A. Hemming. The officers, together with the following, will preside over the twelve industrial groups of the Exhibitors Committee: R. D. DeMott, general sales manager, S.K.F. Industries, Inc.; W. H. Rea, president, Detroit Stoker Co.; J. F. McNamara, sales manager, International Nickel Co.; H. M. Hammond, sales manager, Bailey Meter Co.; Ralph Leavenworth, general advertising manager, Westinghouse Electric & Mfg. Co.; H. M. Shackelford, sales promotion manager, Johns-Manville Corporation; C. F. Radley, publicity director, Oakite Products Co.; N. O. Wynkoop, publishing director, *Power*, McGraw-Hill Publishing Co.

## Handicapped Workers and Students Studied by NRA

Headed by Dr. Stanley P. Davies, director of the Charity Organization Society, a special committee has been appointed by General Johnson to study the problems created by the application of code standards of hours and wages to handicapped workers and college students. Other members of the committee are Oscar Sullivan, president of the National Rehabilitation Association, and Professor Woodward, of the University of Chicago.

## Committee Reports on Shipyard Hours

On December 5, the Fact-finding Committee, appointed on September 22 to study the question of reconciling divergent hours and wages in the shipbuilding industry, reported to the National Labor Board. The report found hours as follows: Navy yards 40; private yards, 32 on government work; 36 on private and ship repairing as provided in the code, and 30 on work paid for out of public funds. It was found that these disparities led to confusion among both management and labor. The majority of the committee stated "that nothing less than a uniform work week in all yards including navy yards will put an end to this confusion."

The committee was composed of Deputy Administrator William H. Davis, H. Gerrish Smith, chairman of the Code Authority for the Shipbuilding Industry and president of the National Council of Shipbuilders, and John P. Frey, president, Metal Trades Department, American Federation of Labor. Mr. Davis and Mr. Smith signed the report. Although Mr. Frey did not sign, a letter attached to the report expressed his agreement with the general plan.

# Federal Representatives Chosen for Code Authorities

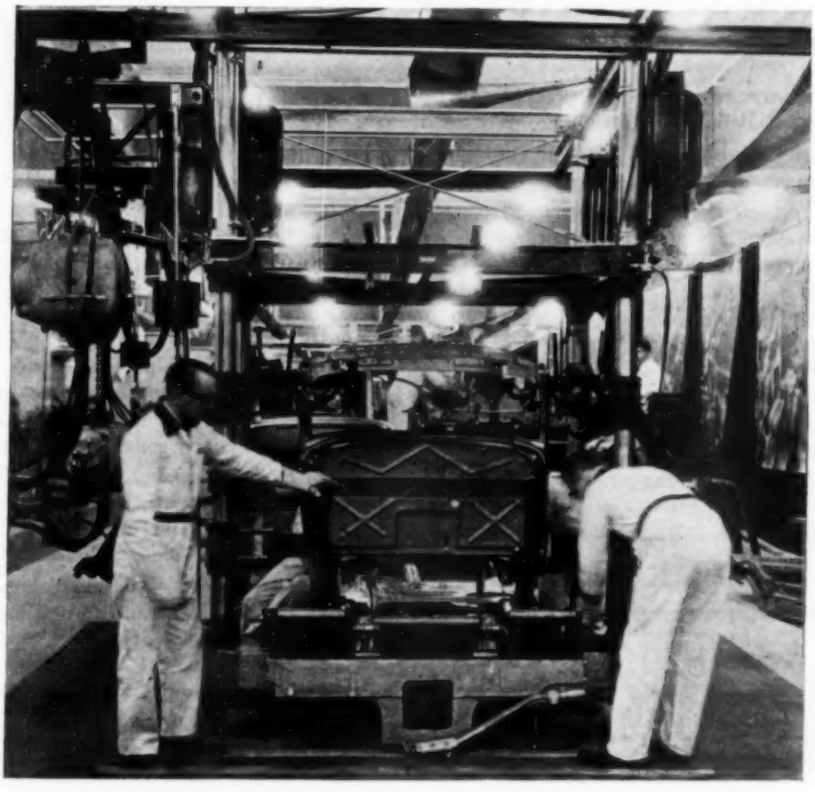
On December 13, General Hugh S. Johnson announced the selection of government representatives to 90 code authorities as provided by agreements already approved by the President. Almost half the codes affected by these appointments are in the metal-working industry.

Between them, Neal W. Foster, former general manager, National Acme Co., and Colonel George S. Brady, former associate editor of *American Machinist*, will represent the government on the major share of the metal-working code authorities. Mr. Foster will sit with the code authorities for the following industries; Anti-friction bearing, boiler manufacturing, buff and polishing wheel, buffing and polishing composition, compressed air, gear manufacturing, heat exchange, industrial supplies and machinery distributing, machine tool and equipment distributing, machine tool and forging machinery, printers' roller, plumbago crucible, pump manufacturing, special tool, die and machine shop, steel tubular and firebox boiler.

Colonel Brady will look out for government interests on the following code authorities: petroleum equipment industry and trade, canning and packing machinery, farm equipment, gas cock industry, knitting, braiding and wire covering machinery, packaging machinery, rock crushing manufacturing, road machinery manufacturing, shovel, dragline & crane, textile machinery manufacturing.

Other governmental appointees to code authorities are: H. O. King, copper and brass mill products and steel castings; Russell M. Searle, all-metal insect screens; H. M. Halsted, Jr., cast iron soil pipe and malleable iron; Carl J. Ammerman, automobiles; Ralph J. Fogg, automatic sprinklers; Lawrence J. Martin, Fabricated Metal Products manufacturing and Metal Finishing and Coating; J. Reed Lane, fire extinguisher and motor fire apparatus manufacturing; William Lawson, pipe nipples; J. G. Cowling, washing and ironing machinery; Beverly S. King, warm air furnaces.

Three government representatives have been appointed for the gasoline pump manufacturing industry. They are R. B. Paddock, R. E. Langston and A. E. Davenport. Mr. Paddock was also appointed to the code authority of the oil bureau industry, together with Leuren E. Seeley, Harold Sweatt and Harry F. Tapp.



**Ford's Own Show—Briggs' exhibit in the Ford Motor Company's Exposition of Progress, now open at the Port of New York Authority Building, includes a series of assembly operations on the 1934 Ford body. The body jig shown above is typical. 150 other exhibitors display their contributions to the new model**

## Machine Tool Orders Show Another Gain

Reports from 78 companies to the National Machine Tool Builders' Association showed a November index of gross orders of 82.8 and an index of net orders of 81.6. This compares with a gross order index of 67.1 for October and 32.0 for November, 1932. Shipments for November at 63.3 were well above last month's figure of 51.7 and last year's 28.9.

The index for unfilled orders reached 115.5, whereas last month it was 105.4, and last year 42.2. The three months' moving average of gross orders for November was 68.6 as compared to 60.1 in October and 29.6 for November, 1933. An important stimulus for the month's business was the influx of foreign business, which reached approximately 41 per cent of the total. In October foreign orders accounted for only 21 per cent.

## Gear Committee Pledges Compliance with Code

At its first meeting held in Wilkinsburg, Pa., on November 24, the code authority of the gear manufacturing industry adopted a resolution pledging its members to carry out the provisions of the code recently approved and to cooperate with the administrator. The code authority is headed by H. H. Kerr, president, Boston Gear Works; its full membership was recently given on these pages (*AM*—Vol. 77, page 692c).

E. S. Sawtelle, of the Tool Steel Gear & Pinion Co., chairman of the commercial standards committee, urged members of the industry not to "chisel," particularly as regards labor, even though some of the terms of the code might prove inconvenient. Mr. Sawtelle said in part, "We may not be as enthusiastic as General Johnson as to the past and future effects of the NRA, but it's the best thing we have, and we must live with it. Let's get in and play the game 100 per cent, stress its strong points rather than its weak points, and try to make the New Deal one for capital as well as for labor by boosting buying power and our own sales."

## • BUSINESS ITEMS •

The Dean Machinery Co., 80 East Jackson Blvd., Chicago, Ill., has been appointed agent for the Chicago territory, by The Michigan Tool Co., Detroit, for its line of gear finishing machines, gear lapping machines, involute testing machines, spiral lead checking machines and other gear checking equipment.

The receivers for the Mead Morrison Mfg. Co., East Boston, Mass., have been ordered to accept the offer of the Textile Machinery & Supply Co., 56 North Main St., Fall River, Mass., for the five buildings of 240,000 sq.ft. floor space, machine tools, equipment and supplies, all of which are now offered for sale by the purchaser.

Udylite Process Co. has opened a branch sales and service office at 708 Keith Bldg., Cleveland, Ohio. J. S. HOFFMAN will be in charge and his assistants will be L. J. GEORGE and C. L. ANGER.

The Universal Power Corp., Cleveland, Ohio, has appointed representatives for its arc welders, accessories and welding electrodes as follows: The Welding Equipment & Supply Co., 2720 East Grand Blvd., Detroit, and F. R. FAULK, 50 Penn Ave., Pittsburgh, Pa.

Joseph T. Ryerson & Son, Inc., of Boston, New York and Chicago, has purchased the stock and good-will of Bacon & Co., Boston, Mass., a pioneer iron and steel company located at 107 Oliver St.

The Sullivan Machinery Co., Michigan City, Ind., will begin the manufacture of compressors by February, 1934, according to A. D. FERGUSON, works manager. The announcement puts at rest rumors which had been current that the company planned to move the Michigan City plant to Claremont, N. H. The Michigan City plant will specialize in diamond core drilling machines and compressors.

Joseph T. Ryerson & Son, Inc., is making extensive additions to its St. Louis, Mo., steel warehouse. New offices, a large heated plant for storage of high-grade steels and improved facilities for shipping are among the improvements.

The Perfect Circle Co. will erect a new manufacturing building at Hagerstown, Ind., with floor space of 50,000 sq.ft.

The Almetal Universal Joint Co., Cleveland, will increase its floor space by 50 per cent and has ordered new machine tool equipment.

Vickers, Inc., Detroit, manufacturers of hydraulic pumps and steering gear booster equipment, is building a new and larger plant at LaSalle and Oakman Blvds.

Massilon Rivet & Mfg. Co., Massilon, Ohio, has purchased the plant formerly occupied by the W. R. Harrison Co. at that city, and will use the plant in the manufacture of automobile springs.

## Howard Coonley Again Heads American Standards Association

At its annual meeting in New York on Dec. 13, the American Standards Association re-elected as its president Howard Coonley, president of the Walworth Co. F. E. Moscovics was re-elected vice-president. J. C. Irwin, valuation engineer, Boston & Albany R.R., and chairman of the standardization committee of the American Railway Engineering Association, was elected chairman of the American Standards Council to succeed Cloyd M. Chapman. S. M. Farmer, chief engineer, Electrical Testing Laboratories, New York, was elected vice-chairman. The principal topic of discussion at the meeting was the consideration of the new problems incident to the broadened scope of the organization brought about by cooperative activities with the Bureau of Standards.

## • OBITUARIES •

CLIFFORD MESSINGER, president of the Chain Belt Co., Milwaukee, Wis., died suddenly Dec. 12.

JAMES A. CAMERON, 60, president and director of the Cameron Mfg. Co., Brooklyn, N. Y., manufacturer of slitting and rewinding machines for paper mills, died Dec. 13. He founded the company in 1906, and was also an inventor of devices for special textile machines.

WILLIAM J. CLARKE, 52, vice-president of the American Socket & Forging Co., Pontiac, Mich., died of a heart attack in Detroit on Dec. 7.

## • MEETINGS •

SOCIETY OF AUTOMOTIVE ENGINEERS. Annual meeting, Jan. 22-25. Book-Cadillac Hotel, Detroit. JOHN A. C. WARNER, secretary, 29 West 39th St., New York, N. Y.

SPECIAL TOOL, DIE & MACHINE SHOP INSTITUTE. Annual meeting, Feb. 5, Cleveland, Ohio. ROY T. WISE, managing director, Suite 336, 7016 Euclid Ave., Cleveland, Ohio.

## • PERSONALS •

T. H. DOAN has been elected president of the Foote-Burt Co., Cleveland, Ohio, to fill the unexpired term of the late GEORGE E. RANDLES T. F. JONES was elected a director to fill the unexpired term of Mr. Randles. R. E. DELAMATER and W. F. BABCOCK were made vice-presidents.

FRANK H. BENDER has been appointed vice-president and general manager of the Lycoming Manufacturing Co., according to W. H. BEAL, president. JOHN E. DUNBAR, formerly purchasing agent, has become assistant general manager.

FREDERICK C. CRAWFORD, vice-president and general manager of the Thompson Products, Inc., Cleveland, has been elected president to fill the vacancy caused by the death of CHARLES THOMPSON.

A. L. HUMPHREY, executive director and former president of the Westinghouse Air Brake Co., Wilmerding, Pa., has been elected chairman of the board, to fill the vacancy left by the recent death of H. H. WESTINGHOUSE.

DR. E. C. GILBERT has been appointed general manager of the Perkins Gear & Machine Co., West Springfield, Mass., succeeding FREDERICK H. RICE, who retains the position of assistant treasurer. Dr. Gilbert was formerly general manager of the Chapman Valve Co.

ARTHUR LANDIS, a vice-president of the Auburn Automobile Co., has been placed in charge of operations at the Auburn, Ind., and Connersville plants.

WILBERT WEAR has been elected president of the Harrisburg Pipe & Pipe Bending Machine Co., Harrisburg. Pa., to succeed the late C. B. HOUCK. Mr. Wear has been treasurer and will continue in that capacity. N. W. CASSEL has been made vice-president and will also serve as secretary. HENDERSON B. LIGGETT, formerly general superintendent, has been made general manager.

J. B. DOAN, president, American Tool Works Co., Cincinnati, has been elected a director of the American Rolling Mill Co., Middletown, Ohio.

JAMES D. MOONEY, president, General Motors Export Corp., and former associate editor, *American Machinist*, was re-elected head of the Manufacturers' Export Association.

ROY T. WISE, managing director of the Special Tool, Die & Machine Shop Institute, Cleveland, left for the Pacific Coast on Dec. 15 for the purpose of holding meetings at important centers as follows: Seattle, Dec. 20; Portland, Dec. 22; San Francisco, Dec. 27; Los Angeles, unscheduled.

American Machinist
REFERENCE BOOK SHEET

# American National Thread Standards

## 16-Pitch Thread Series

### American National 16-Pitch Thread Series

| Identification | | Basic diameters | | | Thread data | | |
|---|---|---|---|---|---|---|---|
| Sizes | Threads per inch | Major diameter, $D$ | Pitch diameter, $E$ | Minor diameter, $K$ | Metric equivalent of major diameter | Helix angle at basic pitch diameter, $\alpha$ | Basic area of section at root of thread, $\frac{\pi K^2}{4}$ |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| | | *Inches* | *Inches* | *Inches* | mm | *Deg. Min.* | *Square inches* |
| ¾ [1] | 16 | 0.7500 | 0.7094 | 0.6688 | 19.050 | 1 36 | 0.3513 |
| ⅞ | 16 | .8750 | .8344 | .7938 | 22.225 | 1 22 | .4949 |
| 1 | 16 | 1.0000 | .9594 | .9188 | 25.400 | 1 11 | .6630 |
| 1⅛ | 16 | 1.1250 | 1.0844 | 1.0438 | 28.575 | 1 3 | .8557 |
| 1¼ | 16 | 1.2500 | 1.2094 | 1.1688 | 31.750 | 0 57 | 1.0729 |
| 1⅜ | 16 | 1.3750 | 1.3344 | 1.2938 | 34.925 | 0 51 | 1.3147 |
| 1½ | 16 | 1.5000 | 1.4594 | 1.4188 | 38.100 | 0 47 | 1.5810 |
| 1⅝ | 16 | 1.6250 | 1.5844 | 1.5438 | 41.275 | 0 43 | 1.8719 |
| 1¾ | 16 | 1.7500 | 1.7094 | 1.6688 | 44.450 | 0 40 | 2.1873 |
| 1⅞ | 16 | 1.8750 | 1.8344 | 1.7938 | 47.625 | 0 37 | 2.5272 |
| 2 | 16 | 2.0000 | 1.9594 | 1.9188 | 50.800 | 0 35 | 2.8917 |
| 2⅛ | 16 | 2.1250 | 2.0844 | 2.0438 | 53.975 | 0 33 | 3.2807 |
| 2¼ | 16 | 2.2500 | 2.2094 | 2.1688 | 57.150 | 0 31 | 3.6943 |
| 2⅜ | 16 | 2.3000 | 2.4594 | 2.4188 | 63.500 | 0 28 | 4.5950 |
| 2¾ | 16 | 2.7500 | 2.7094 | 2.6688 | 69.850 | 0 25 | 5.5940 |
| 3 | 16 | 3.0000 | 2.9594 | 2.9188 | 76.200 | 0 23 | 6.6911 |
| 3¼ | 15 | 3.2500 | 3.2094 | 3.1688 | 82.550 | 0 21 | 7.8864 |
| 3½ | 16 | 3.5000 | 3.4594 | 3.4188 | 88.900 | 0 20 | 9.1799 |
| 3¾ | 16 | 3.7500 | 3.7094 | 3.6688 | 95.250 | 0 18 | 10.5715 |
| 4 | 16 | 4.0000 | 3.9594 | 3.9188 | 101.600 | 0 17 | 12.0614 |

[1] Standard size of the American National fine-thread series

NOTE.—Pitch, $p=0.06250$ inch; depth of thread, $h=0.04059$ inch; basic width of flat, $p/8=0.00781$ inch; minimum width of flat at major diameter of nut, $p/24=0.00260$ inch

New material added to the Report of the National Screw Thread Commission (revised 1933), includes specifications, reproduced here, of the 16-pitch thread in sizes from ¾ to 4 in. The American National form of thread profile is used. One of the tables gives the nominal sizes and basic dimensions, whereas the other presents limiting dimensions and tolerances, classes 2 and 3 fits.

The 16-pitch series is a uniform pitch series for such applications as require a relatively fine thread. It is intended primarily for use on thread adjusting collars and bearing retaining nuts.

### Limiting Dimensions and Tolerances, Class 3 Fit, American National 16-Pitch Thread Series

| Dimensions and tolerances [1] | | Size (inches) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ¾ [2] | ⅞ | 1 | 1⅛ | 1¼ | 1⅜ | 1½ | 1⅝ | 1¾ | 1⅞ | 2 | 2⅛ | 2¼ | 2⅛ | 2½ | 3 | 3¼ | 3½ | 3¾ | 4 |
| BOLTS AND SCREWS | | *In.* | *In.* | *In.* | *Ins.* | *Ins.* | *Ins.* | *Ins.* | *Ins.* | *Ins.* | *Ins.* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* |
| Major diameter | Max. | 0.7500 | 0.8750 | 1.0000 | 1.1250 | 1.2500 | 1.3750 | 1.5000 | 1.6250 | 1.7500 | 1.8750 | 2.0000 | 2.1250 | 2.2500 | 2.5000 | 2.7500 | 3.0000 | 3.2500 | 3.5000 | 3.7500 | 4.0000 |
| | Min. | .7410 | .8660 | .9910 | 1.1160 | 1.2410 | 1.3660 | 1.4910 | 1.6160 | 1.7410 | 1.8660 | 1.9910 | 2.1160 | 2.2410 | 2.4910 | 2.7410 | 2.9910 | 3.2410 | 3.4910 | 3.7410 | 3.9910 |
| | Tol. | .0090 | .0090 | .0090 | .0090 | .0090 | .0090 | .0090 | .0090 | .0090 | .0090 | .0090 | .0090 | .0090 | .0090 | .0090 | .0090 | .0090 | .0090 | .0090 | .0090 |
| Minor diameter | Max. [3] | .6733 | .7983 | .9233 | 1.0483 | 1.1733 | 1.2983 | 1.4233 | 1.5483 | 1.6733 | 1.7983 | 1.9233 | 2.0483 | 2.1733 | 2.4233 | 2.6733 | 2.9233 | 3.1733 | 3.4233 | 3.6733 | 3.9233 |
| Pitch diameter | Max. | .7094 | .8344 | .9594 | 1.0844 | 1.2094 | 1.3344 | 1.4594 | 1.5844 | 1.7094 | 1.8344 | 1.9594 | 2.0844 | 2.2094 | 2.4594 | 2.7094 | 2.9594 | 3.2094 | 3.4594 | 3.7094 | 3.9594 |
| | Min. | .7062 | .8308 | .9557 | 1.0806 | 1.2056 | 1.3305 | 1.4554 | 1.5803 | 1.7053 | 1.8302 | 1.9551 | 2.0801 | 2.2050 | 2.4549 | 2.7048 | 2.9547 | 3.2046 | 3.4545 | 3.7044 | 3.9543 |
| | Tol. | .0032 | .0036 | .0037 | .0038 | .0038 | .0039 | .0040 | .0041 | .0041 | .0042 | .0043 | .0043 | .0044 | .0045 | .0046 | .0047 | .0048 | .0049 | .0050 | .0051 |
| NUTS AND TAPPED HOLES | | | | | | | | | | | | | | | | | | | | | |
| Major diameter | Min. [4] | .7500 | .8750 | 1.0000 | 1.1250 | 1.2500 | 1.3750 | 1.5000 | 1.6250 | 1.7500 | 1.8750 | 2.0000 | 2.1250 | 2.2500 | 2.5000 | 2.7500 | 3.0000 | 3.2500 | 3.5000 | 3.7500 | 4.0000 |
| Minor diameter | Min. | .6823 | .8073 | .9323 | 1.0573 | 1.1823 | 1.3073 | 1.4323 | 1.5573 | 1.6823 | 1.8073 | 1.9323 | 2.0573 | 2.1823 | 2.4323 | 2.6823 | 2.9323 | 3.1823 | 3.4323 | 3.6823 | 3.9323 |
| | Max. | .6993 | .8141 | .9391 | 1.0641 | 1.1891 | 1.3141 | 1.4391 | 1.5641 | 1.6891 | 1.8141 | 1.9391 | 2.0641 | 2.1891 | 2.4391 | 2.6891 | 2.9391 | 3.1891 | 3.4391 | 3.6891 | 3.9391 |
| | Tol. | .0080 | .0068 | .0068 | .0068 | .0068 | .0068 | .0068 | .0068 | .0068 | .0068 | .0068 | .0068 | .0068 | .0068 | .0068 | .0068 | .0068 | .0068 | .0068 | .0068 |
| Pitch diameter | Min. | .7094 | .8344 | .9594 | 1.0844 | 1.2094 | 1.3344 | 1.4594 | 1.5844 | 1.7094 | 1.8344 | 1.9594 | 2.0844 | 2.2094 | 2.4594 | 2.7094 | 2.9594 | 3.2094 | 3.4594 | 3.7094 | 3.9594 |
| | Max. | .7126 | .8380 | .9631 | 1.0882 | 1.2132 | 1.3383 | 1.4634 | 1.5885 | 1.7135 | 1.8386 | 1.9637 | 2.0887 | 2.2138 | 2.4639 | 2.7140 | 2.9641 | 3.2142 | 3.4643 | 3.7144 | 3.9545 |
| | Tol. | .0032 | .0036 | .0037 | .0038 | .0038 | .0039 | .0040 | .0041 | .0041 | .0042 | .0043 | .0043 | .0044 | .0045 | .0046 | .0047 | .0048 | .0049 | .0050 | .0051 |

[1] Pitch diameter tolerances include errors of lead and angle, and are 70 percent of the tolerances for class 2 based on the formulas in table 60 and a length of engagement of 6 threads or ⅜ inch. The ¾-inch size being in the American National fine-thread series, the tolerance for this size corresponds to that series.

[2] Standard size screw and nut of the American National fine-thread series.

[3] Dimensions given for the maximum minor diameter of the screw are figured to the intersection of the worn-tool arc with a center line through crest and root. The minimum minor diameter of the screw shall be that corresponding to a flat at the minor diameter of the minimum screw equal to $\frac{1}{16}\times p$, and may be determined by subtracting 0.0406 inch from the minimum pitch diameter of the screw.

[4] Dimensions for the minimum major diameter of the nut correspond to the basic flat ($\frac{1}{16}\times p$) and the profile at the major diameter produced by a worn tool must not fall below the basic outline. The maximum major diameter of the nut shall be that corresponding to a flat at the major diameter of the maximum nut equal to $\frac{1}{24}\times p$, and may be determined by adding 0.0496 inch to the maximum pitch diameter of the nut.

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## • NEW BOOKS •

ENGINEERING SHOP PRACTICE, VOL. I. *By O. W. Boston, Professor of Shop Practice, University of Michigan. 539 pages, 5⅞x9 in. Indexed and illustrated. Cloth-board binding. Published by John Wiley & Son, 440 Fourth Ave., New York, N. Y. Price $5.50.*

Based on his years of teaching the subject of machine shop practice at Michigan, Professor Boston has developed a text book that effectively brings the operations of the metal-working shop to the classroom. The volume is profusely illustrated with views of equipment and drawings showing the principles of metal cutting. At the end of each chapter is a complete bibliography of previous works and articles that have appeared in the technical press. A set of questions also accompanies each chapter to facilitate a review of the subject matter.

"Engineering Shop Practice" should serve to make the subject of mechanical engineering much more realistic to the student who, unless he has had some practical shop experience, is likely to regard many of his courses as technical theory. Professor Boston's practical approach serves as a tie between the theoretical aspect of engineering and the actual job of production which many students will face upon their graduation. This volume is to be followed by another which will round out the subject, and which is now in the process of preparation.

Volume I gives an historical review of the machine shop and a classification of its equipment. It then enlarges on the subject of cutting tools for lathes, planers and shapers and treats at length milling, sawing, drilling, boring, reaming and threading.

INDUSTRIAL RESEARCH LABORATORIES OF THE UNITED STATES. *Bulletin No. 91 of The National Research Council. Released August, 1933. Compiled by Clarence J. West and Callie Hull. 223 pages, 6¾x9¾ inches. Paper covers. Published by the National Research Council of The National Academy of Sciences, Washington, D. C. Price, $2.*

1562 industrial companies maintaining research laboratories are listed in this bulletin. Research laboratories of colleges and universities, and commercial testing laboratories are not included. In each case the product of the company, the type of research engaged in, and the size of the research staff with the name of its director are given. The laboratories are indexed by geographical distribution and by subject. This bulletin should be invaluable to anyone wanting to know where any particular type of research is being conducted, and by whom.

PRINCIPLES OF INDUSTRIAL ORGANIZATION. *Fourth Edition. By Dexter S. Kimball, dean, college of engineering, Cornell University, and editor, McGraw-Hill Industrial Management Series. 460, 6x9 in. pages, Indexed. Cloth. Published by the McGraw-Hill Book Co., Inc., 330 West 42nd St., New York, N. Y. Price, $4.*

Dean Kimball says that it is difficult to cover the principles of industrial organization in one volume. True, but he has done so in concise form in 26 chapters, and has added, where necessary, a careful selection of references to other authors and their more extended treatment of the subject in hand. In this respect, the took is of particular worth, as it enhances the instructional value and guides the student to a well-read grasp of the subject. Of course, the book is a standard work, running into its fourth edition. Just now it should be of aid to more mature engineers and managers who want or need a new understanding of the fundamentals of industrial organization.

TRADE ASSOCIATIONS. *By W. J. Donald, Management Counselor. 437 pages, 6x9 inches. Bound in cloth boards. Published by McGraw-Hill Book Company, Inc. New York and London. Price $4.*

When the National Industrial Recovery Act was planned it was assumed that the great majority of American business and industry was organized in effective trade associations. How far from the truth this assumption was came out shortly after the Act was passed. The well organized industries were the exception rather than the rule. Since the struggle to get organized on a sound and constructive basis is still going on and will continue for months to come, this volume is particularly timely.

The author brings unique qualifications to his task. He was for several years managing director of the American Management Association, and then and since he has been called upon many times to consult on trade association problems. To those who are or have been members of A.M.A., Mr. Donald's ability to practice what he preaches in planning and conducting meetings and in carrying on an association is an old story.

To all those who are struggling with trade association questions of any kind this book should be of real assistance.

SAE HANDBOOK 1933 EDITION. *733 pages, 5⅜x8⅜ in. Published by the Society of Automotive Engineers, New York. $5 to non-members.*

The noticeable feature of the new book is the increase in page size, to which all new material is being set. This enables one to note the pages taken from the former volume which indicate that no change in standards has been made since the last edition. These added pages will disappear as specifications are revised. A new group classification has been adopted so that specifications will be grouped according to type rather than to the particular kind of automotive apparatus to which they may apply. This is done because, in many cases, specifications apply to more than one kind of apparatus. As an indication of the changes that have taken place no less than 43 specifications appearing in previous issues have been omitted from this volume.

THE TECHNICAL MAN SELLS HIS SERVICES. *By Edward Hurst. 239 pages, 5½x8 in., bound in cloth boards. Published by McGraw-Hill Book Co., Inc., New York and London. Price $2.*

Mr. Hurst has had pronounced success in his lectures to seniors at Massachusetts Institute of Technology on how to get a job. This volume is based on his lectures and has been tried at M.I.T. as a private edition for the class of 1933. After outlining his thesis that the technical graduate must sell himself to his prospective employer as a profitable investment, Mr. Hurst tells how to plan for the crucial interview. He then gives complete details of ten cases including all the different types of technical preparation, from civil engineering to financial management.

In his preface the author remarks that writing is not his profession. The casual character of his punctuation and construction is sufficient proof of the truth of his admission from a narrowly technical viewpoint. A little editing would have helped considerably. Yet the presentation of his ten cases is so realistic and human that the reader soon forgets the minor faults.

If there is anything that is open to criticism it is the facility with which callow graduates acquire $3,000 jobs in several of his cases. To the captious this may have just a touch of the Horatio Alger style. In spite of this drawback the book should prove of real value to the young engineer.

# THE ROUND TABLE

## Uniform Accounting

"Hello, Al. Well this is a pleasure to see you back in the old shop again. The boy who made good revisits the scene of his early endeavors, eh? What brings you up here?"

"Oh, I came up to see Brown, your treasurer, and stopped to talk with Williams and you. Too bad so many of the old boys have gone."

"Yes, I miss them, and the company'll miss them when business picks up, too. I didn't know that you and our treasurer were on speaking terms. Remember that run-in you and he had on that pump business?"

"Yes. At the time I thought I was fighting for a principle, but time and experience teach that it was only a slight misunderstanding. He's an old fogey, though. I didn't get anywhere with him today."

"Where were you trying to get to?"

"Oh, the Manufacturers' Association has appointed a committee to look into the matter of uniform accounting, and I was elected to get ideas from the metal-working shops."

"Yeah, I remember you used to do some spouting about our accounting when you were here. What did Brown have to say?"

"Oh, the usual thing. He was in favor of uniform accounting, but his business was different and the directors required such different accounts that he didn't believe they could be made uniform with other concerns even in the same business. Every place I go I get that same song. 'Our business is different.'"

"Well, they're all alike in being different, anyhow."

"Yes; and they're all alike in some other respects, too. Nobody expects that the accounting in all industries will be alike, but there are certain items that are alike in every industry and more that are alike in the same industry."

"Well, why should accounts be uniform? Why not let each one keep accounts as he wants to, or not keep any at all? Didn't I understand you to say that you were not going to keep any accounts at all?"

"You heard me say that I wasn't going to keep accounts that don't mean anything. Uniform accounts do mean something. They are a means of comparison, but different cost methods for each shop don't mean a thing, and it's a waste of money to keep them if the owner himself is on the job all the time."

"If our competitors knew our costs they could cut under our prices easier than they do now. Now, they have to guess; if they had our costs they could cut under with certainty."

"There's two answers to that statement, big boy. In the first place, having uniform accounting doesn't mean that the costs will be equal, or that everybody will know your costs. It means that each manufacturer in a given trade will keep costs on the same items and will charge them to the same ledger account. As the resolution has it, the object is to improve competitive conditions by providing basic cost information on which to develop adequate price policies within an industry; and to increase operating efficiency through the development of a more intimate knowledge of costs and through comparisons of the performance of individual companies with the average or normal results for the industry. It isn't the man who keeps costs that does the cutting. It's the one that doesn't know; if he knew just what his costs were the chances are that he wouldn't cut. That's one of the benefits of uniform cost accounting."

"And yet you have no cost accounting system at all."

"Yes, but ———"

"Sure, I understand, your business is different."

***Is uniform accounting within an industry practicable? Is it reasonable that a knowledge of costs will prevent uncontrolled price cutting?***

## *Discussion*

### The Buyer

The idea of having the purchasing agent act as an all-around watch dog is fully as absurd as having our President responsible for all the curves, twists and turnings of the NIRA. The job of Mr. Roosevelt is far too important for him to be held responsible for minor matters. General Johnson was appointed for that very reason.

The purchasing agent's job is too important for him to waste his time in handling the storeroom, taking charge of the receipt of material, etc. He has but one duty—to purchase—and to perform that duty properly it is necessary for him to give his undivided attention to it.

He should not be bothered with the receiving of material. The receiving clerk should be capable of checking the material and seeing that all of it is accounted for. If there are any complaints, the purchasing agent should be notified at once. While the purchasing agent should know what materials are best, he should not be expected to

wander about the shop checking up on results—that is up to the foreman of each division. —WILL HERMAN,
*Superintendent, Tanenbaum Oil Company.*

Personally, I have often found that when confronted with a knotty problem I can frequently solve it by taking an example from one of my youngsters. After reading Al's discussion and Ed's arguments on the subject of purchasing agents, I asked my eldest boy, "Who does the buying in your athletic club, son?"

"George Brown," he said.

"Suppose he orders equipment; who is responsible to see that it arrives and is in good condition?"

"Why he is. There'd be no sense in having someone else do it. He knows what we want; he buys it, and he sees that we get it. That's his job."

There is the answer in a nutshell. The man who is filling the position of purchasing agent must see that the material is on hand. That's his job. I will admit that where the amount of business and the quantity of material are enormous, the purchasing agent should have a number of assistants. But he would do a better job if it were possible for him to handle it alone.

—FRED BENNETT,
*Superintendent, Standard Products Company.*

## Doing Without

Whether or not Al believes in inspection, he must have inspection of some kind if his product is composed of interchangeable parts. He need not have a special force in a separate department equipped with a lot of special gages and devices, but he must have some way of knowing that his parts are held within the required limits.

Since Al's production is small and the work comes through in small lots, he can not use ordinary machine operators as inspectors, but must use his higher grade men. They can be trusted to do all the necessary parts inspection, since they perform various operations in machining and assembling the product. They know almost instinctively what dimensions of the parts must be held closely and will naturally do the work right and inspect as a routine matter.

Properly designed tools and fixtures help to prevent errors and to maintain accuracy, but they cannot be expected to check everything. Any shop will benefit by having a good foreman, but he cannot do everything that is to be done in the shop. He can direct the work, but he cannot personally oversee each operation; he must rely on his men to carry out his instructions to the letter.

—L. O. BROWN.

I have worked in shops that were operated successfully without inspectors, and I have also worked in drafting rooms without checkers. Providing everyone in an organization understands that he is responsible for all his work and actions, a shop can be successfully operated without checkers and inspectors. This doing without must start in the front office and be carried through engineering, tool-designing and production departments. Every employee must be instilled with the same spirit of responsibility, also with pride in his work and in the company.

When men are taught that they are

working for a principle, then it is safe to eliminate checking and inspection. There is one thing, however, that must not be eliminated, and that is efficient checking means and gages. Good tools and fixtures will help the men to produce good parts, but there must be some way to tell when the operations performed are correct, and men will check their own work if given good gages. In many cases an operator will check a finished part while his machine is working on another piece, thus saving the cost of an inspector. —C. F. STAPLES.

## Thirty-Hour Week

It is apparent that, in the past, industry has failed to regulate itself, hence the need for drastic governmental action in an attempt to provide necessities for people who have been impoverished by the anarchistic methods of other people who have controlled industry and have taken out of it more than they have put in.

Every improvement in machinery should lessen the toil of the workers and enable the consumers to get more for their money. If a thirty-hour week will enable production of an abundance for all, then it appears foolish for people to work longer, or to produce more than they need. The present serious state of industry requires more drastic treatment than can be given it by men of Al's caliber, who have made such a mess of things.

An autocratic form of government may be more efficient than a democratic form for bringing order out of chaos for the time being by restricting individual freedom, but it will be a dangerous experiment if it is not controlled by the principle of absolute equity. Equity, requires the work-duration unit of exchange to make it effective, and until that is accepted and used for the equitable exchange of human work, as we now use a yardstick or a pound weight for measuring material things, industrial recovery will be more or less temporary. —L. BROWN,
*Montreal, Canada*

Al and Mason need have no fear in installing a second shift, providing they keep their equipment up to par. The increased machine hours without the corresponding overhead will offset any slight production losses caused by spoilage. If the working hours of the two shifts are alternated each fortnight, Al and Mason will have the opportunity of contacting with each workman. And new men always bring new ideas with them.

Sound economics dictate the shorter week with wages in line with prevailing prices of commodities. The Recovery Act is not a cure-all and will exert hardships in some quarters. However, the small manufacturer will be immune from most of these hardships, since he has had direct control over his business during these distressing times, and knows where he stands financially today.

Some of the larger concerns, however, have operated to capacity, curtailed purchasing and replacement of equipment, and have cut prices in order to secure the lion's share of what little business was to be had. Their equipment has depreciated in value and is inefficient, and low wages have demoralized their personnel. They are in no position to compete with better-equipped plants in their particular line.

—IRA S. WILLIAMS.

Al is lukewarm about the NIRA simply because he lacks sufficient equipment to warrant employing more men. This may be an alibi for the small contract shop with limited facilities, but there are countless shops employing hundreds on full time, and if these were to go on a short week, a great many new jobs would be opened.

Putting unemployed men to work means the restoration of their purchasing power, and better still, the removal of their names from the welfare relief lists. This will bring a reduction in appropriation for relief, thereby eliminating unpopular nuisance taxes levied by various cities and states. Al offers no objections to putting on more men; he only makes excuses for not doing so. By stepping up his machines from a 45-hour to a 60-hour basis he could employ two shifts of 30 hours each, dividing the week as may seem best to him.

—SAMUEL KAUFFMAN.

# • IDEAS FROM PRACTICAL MEN

## Threading Rolls Synchronized With the Machine Spindle

P. F. ROSSMAN

In thread-rolling set-ups, the accuracy and uniformity of the thread produced is essentially dependent upon an efficient rolling-tool construction; that is, a fixture in which the roll spindles are in, and will retain, accurate alignment with a minimum of wear. The rolls must be synchronized through proper locating keys and gearing. Replacement of rolls without necessitating complete disassembling the fixture is of extreme importance. Freedom from chip interference in the gearing is also a condition to be considered, because, since in customary set-ups, the rolls are rotated by frictional contact with the work, therefore, chips that might be forced or washed into the gears by the cutting coolant or oil would cause slippage, resulting in crossed or burred threads.

The illustrations show how the above mentioned conditions have been met successfully in the design of a thread-rolling tool; a construction in which driving the rolls by frictional contact with the work has been eliminated through the medium of gearing. This feature simplifies the initial set-up for roll pressure for thread depth, also for the removal and replacement of the threading rolls, which can be done without disassembling the unit. It is to be understood that the gearing maintains the correct ratio of rotation between the machine spindle and the rolls. As typical for this case, the machine spindle makes seven revolutions while the rolls make one, seven being the thread-roll multiple.

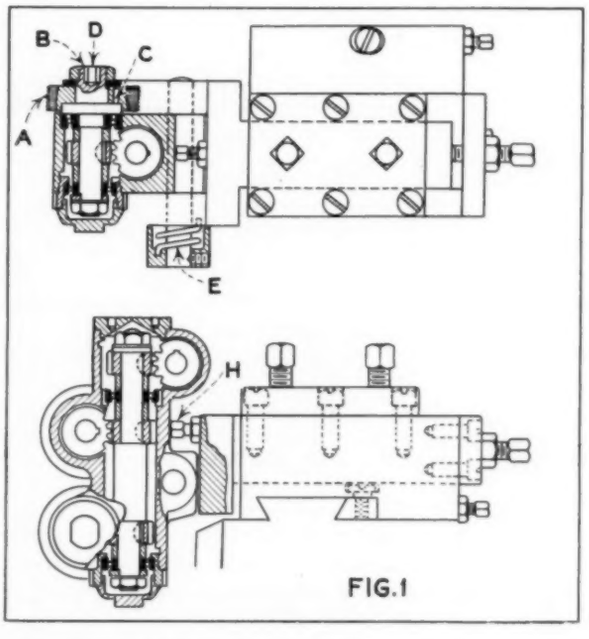



**Fig. 1—In this design of thread rolling tool, frictional driving contact has been eliminated. This simplifies the initial set-up for roll pressure, for thread depth, and for replacement of the rolls**

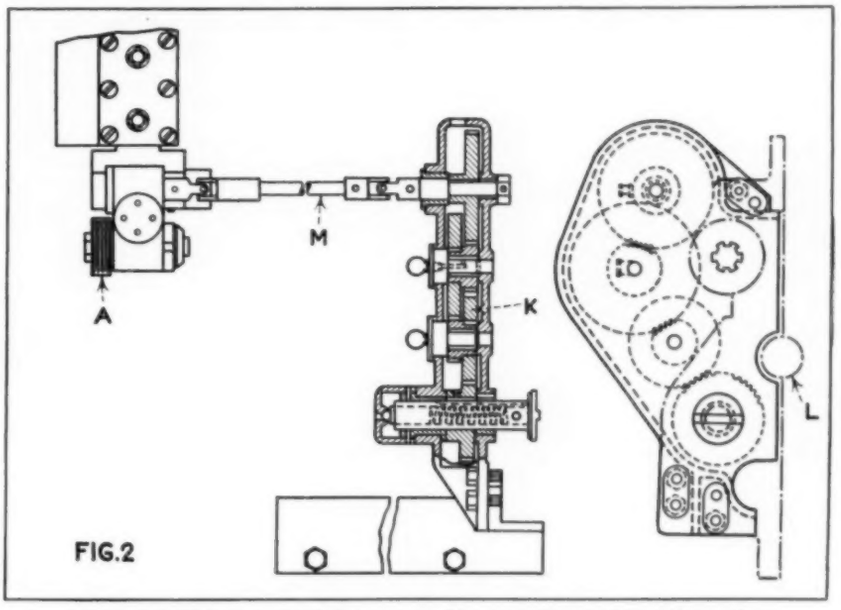



**Fig. 2—This gear train insures the proper synchronizing of the threading rolls with the sprindle of the machine at all times**

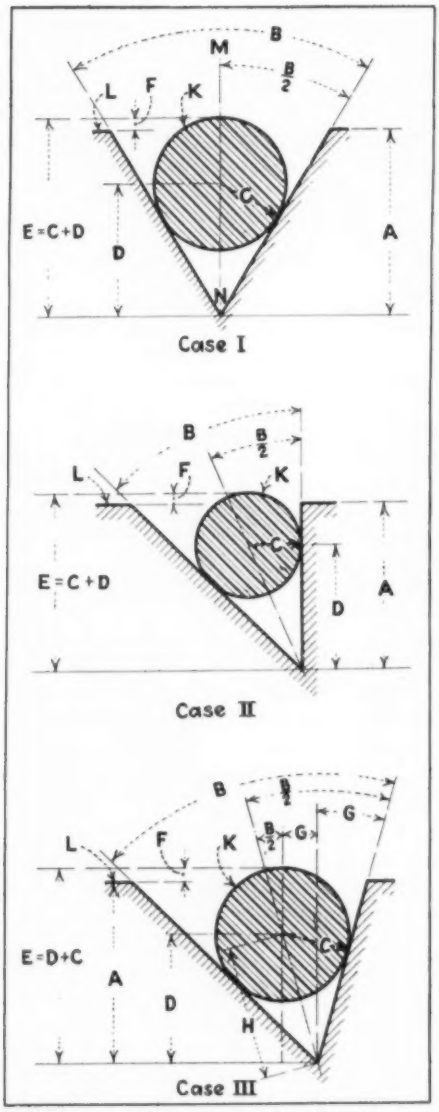
As indicated in Fig. 1, the thread roll *A* is mounted on the spindle *B* and is both located and driven by the pin *C*, being held in place by a nut. To prevent rotation of the spindle while the nut is being tightened or loosened, a wrench of the type used for safety set-screws is inserted in the hexagonal hole *D*. The spindles and the driving shaft are mounted in ball bearings and rotation of the spindles is imparted by the driving shaft through helical gears. The unit is periodically packed with heavy grease, which is the only lubricant required. The torsion spring *E* prevents teetering of the tool while approaching the working position by holding the housing against the stop *H* until the rolls contact with the work and are centralized.

In Fig. 2 is shown how the proper synchronization is maintained between the threading rolls and the spindle of the machine by means of the gear train *K*, which is driven from the drive shaft *L* of the machine. The telescopic shaft *M* has universal joints and connects the gear box of the machine with the thread rolling unit.

## Measuring V's With Rod or Wire

EDWARD HELLER

Measuring V-slots by means of a wire or a rod is often the despair of a great many machinists and toolmakers. However, an analysis of the problem will show that it is very simple. There are but three cases of the problem and the solutions are very similar.




**V-slots can be measured with wires in much the same way as threads**

Case I represents the problem as it is most often encountered. The slot is symmetrical about the line *M-N*, which is perpendicular to the main axis of the job. The information given is, in most cases, as shown in the illustration; that is the depth *A*, the angle *B* between the two faces and the angle *G* in case III. If the information is given in different terms it can be easily converted into the desired dimensions.

The size of the rod *K* is arbitrary and is chosen with a view of having it touch the sides of the V approximately in the middle. It will be noted that this condition can be fulfilled in Case I only. In the other two cases the rod cannot touch the middle of both sides at the same time, so a happy medium must be sought for.

The solution for Case I is as follows:

$$D = C \times \csc \frac{B}{2}$$

$$E = D + C$$

and $F = E - A$ or $A - E$, depending on which is the larger, and that, in turn, depends on the size of rod *K* used. A large rod will, of course, project above the height *A*, as shown in the sketch, while a smaller rod will fall below that point.

Case II is a V of the buttress-thread type, and the solution is practically the same as for Case I, except that a different trigonometric function is used. The solution for Case II is as follows:

$$D = C \cot \frac{B}{2}$$

$$E = D + C$$

and $F = E - A$ or $A - E$. Here again, the last equation will depend on the size of the rod *K*.

Case III is the most complicated, but the solution is fairly simple. In this case, the angle is not symmetrical and no side of the V is perpendicular or parallel to any side of the work. The solution for Case III is a follows:

$$H = C \times \csc \frac{B}{2}$$

$$D = H \times \cos\left(\frac{B}{2} - G\right) = C \times \csc \frac{B}{2} \times \cos\left(\frac{B}{2} - G\right) \quad \ldots\ldots\ldots (1)$$

$$E = D + C$$

and $F = E - A$ or $A - E$

Another phase can be worked out in these problems so as to choose the rod *K* of such a size that *F* will equal zero. All that would be necessary would be to run an indicator over the rod *K* and the top surface of the work at *L*. In that case, the equation would have to be worked out to solve for *C*. In all cases, the solution is based on the fact that $C\ D = A$. For Case I, the solution is as follows:

$$C + D = A$$

$$C = D \times \sin \frac{B}{2}$$

Subtract

$$D = A - \left(D \times \sin \frac{B}{2}\right)$$

$$D\left(1 + \sin \frac{B}{2}\right) = A$$

$$D = \frac{A}{1 + \sin \frac{B}{2}}$$

from (2)

$$C = A - D = A - \frac{A}{1 + \sin \frac{B}{2}} = \frac{A\left(1 + \sin \frac{B}{2}\right) - A}{1 + \sin \frac{B}{2}} = \frac{A \times \sin \frac{B}{2}}{1 + \sin \frac{B}{2}}$$

and this can be simplified to:

$$C = \frac{A}{1 + \csc \frac{B}{2}}$$

The solution for Case II is similar to the one for Case I.

$$C + D = A$$

$$C = D \tan \frac{B}{2}$$

By going through the same process of calculations as for Case 1, we end up with

$$C = \frac{A \times \tan \frac{B}{2}}{1 + \tan \frac{B}{2}}$$ which can be simplified to:

$$C = \frac{A}{1 + \cot \frac{B}{2}}$$

In Case III, we start out as before with

$$C + D = A \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

and then substitute the value for *D*, as given in formula (1), then

$$C + \left[C \times \csc \frac{B}{2} \times \cos\left(\frac{B}{2} - G\right)\right] = A$$

Factoring *C*, we get

$$C = \frac{A}{1 + \left[\csc \frac{B}{2} \times \cos\left(\frac{B}{2} - G\right)\right]}$$

In each case a rod of radius *C*, or diameter 2 *C*, will fall into the slot and its top will be flush with surface *L*.

## Setting a Jig-Borer Spindle Central With the Edge of Work *Discussion*

CHARLES KUGLER

The tool described by R. F. Moore (*AM*—Vol. 77, page 477) reminds me of a little tool that I have had in my kit and have used for the same purpose for the past twenty years.

It is simply a bushing having the lower part cut away for half the diameter, as shown in the illustration. Any piece of metal having a straight hole will answer the same purpose.

While hardened and ground plugs fitting the spindle are sometimes used instead of the indicator, they seldom run dead true and accurate results can not be obtained unless the amount of run out is allowed for.

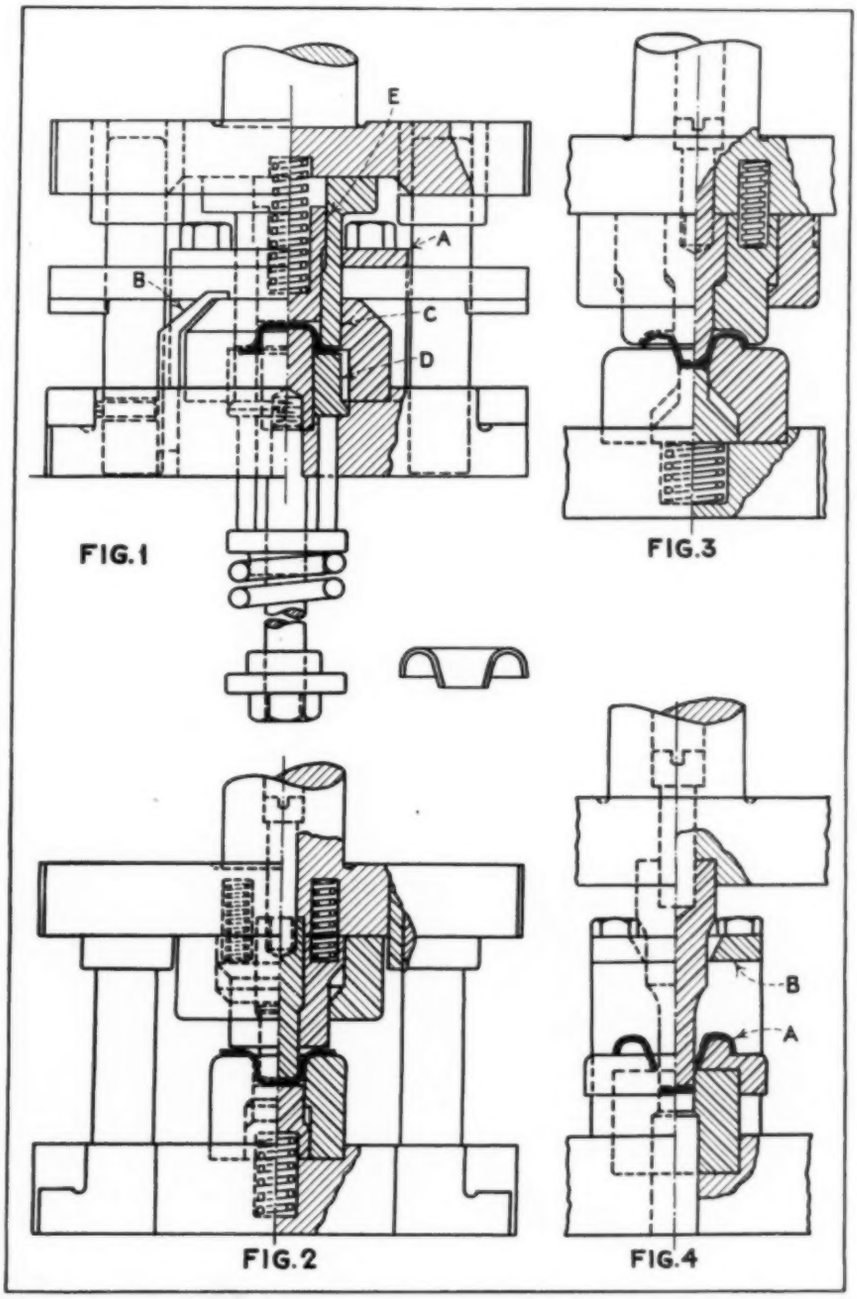
## Press Tools for Valve Spring Guides

JOHN G. JERGENS

Valve spring guides as shown in the center are made in such quantities that the life of dies as well as the method must be considered. The first operation is seen in Fig. 1, where the piece is blanked and given the first draw. The stock is fed under the stripper *A* to the stop *B*. The punch *C* cuts the blank to the developed size and, as it descends the outer portion of *C* acts as a die and forms the cup over the punch below. The center part of the punch recedes against the spring above it while the outer part of the punch *D* is depressed. On the return stroke the spring beneath makes *D* act as a stripper.

A second operation reduces the diameter of the cup as in Fig. 2, a central spring actuated stripper being used. A punch and die of similar design, Fig. 3, forms the cup ready for piercing the central hole which is done in Fig. 4. The piece is located on the form at *A*, and after being pierced is stripped from the punch on its up stroke by the plate *B*.

By dividing the operations the dies are kept simple and have a long life.



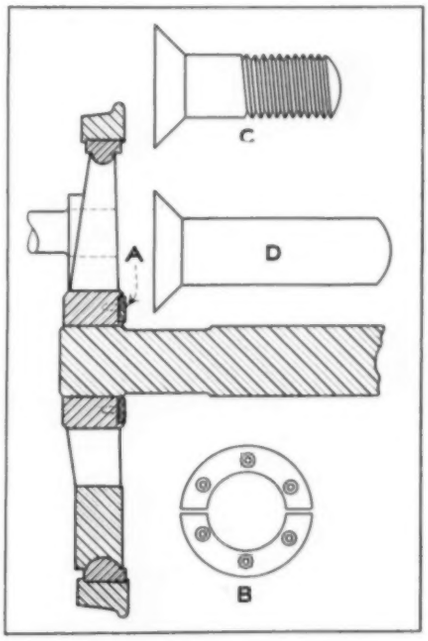

**These dies complete the valve spring guide in four operations. They are designed for long life as well as high production**

## Securing Hub Liners to Locomotive Driving Wheels

DAVID WILLIAMS

On some railroads, brass hub liners are used on the driving wheels, while on some others anti-friction metal is cast on the wearing faces of the driving boxes. When the wheel hubs wear so that there is too much lateral motion, they are faced off to the limit of thickness and steel or cast-iron hub liners are applied, as at *A* in the illustration. In such cases, the liners are in halves, as at *B*, so that they can be applied without dismounting the wheels from their axles.

It has long been the practice to secure hub liners to the wheels with threaded studs, one of which is shown



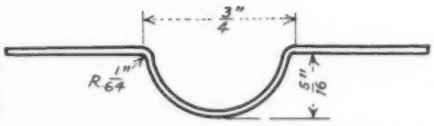

**Threaded studs and plain rivets for securing hub liners**

at *C*, riveted over into countersunk holes in the liners. By actual experience it has been proved that the liners can be secured with countersunk-head rivets held in the hubs by drive fit only. Rivets like the one at *D* are made in the turret lathe and the bodies are a few thousandths larger in diameter than that of the holes drilled in the hubs. The heads are beveled at an angle of 45 deg. and are of a length to bring them about $\frac{1}{8}$ in. below the wearing surface of the liners. Care is taken to drill the holes in the hubs deep enough so that the rivets will not bottom.

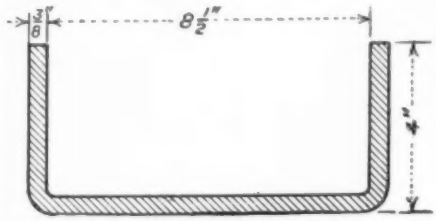
Driven with a long-stroke pneumatic hammer, the rivets will hold the liners tightly from shopping to shopping, while the threaded studs screwed into the hubs and riveted over will work loose.

# Press Work Pressures

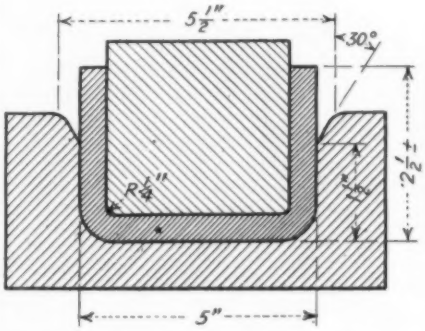
## Series XXIII—*Forming*



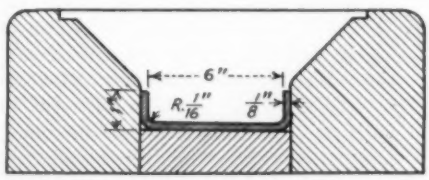

Material--Steel, No. 22 gage, 0.03125 in. thick by 1 in. wide
Operation--Form as shown
Pressure--8,500 lb.



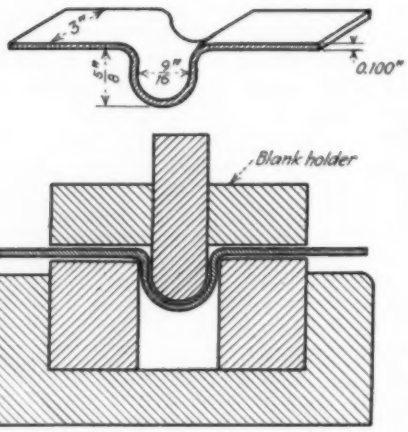

Material--Machine steel, 3/8 in. thick by 3 in. wide
Operation--Form as shown
Pressure--40,000 lb.



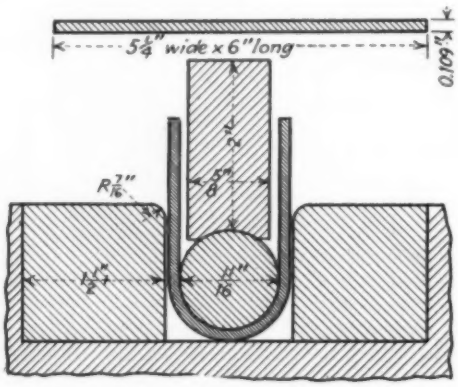

Material--Machine steel, 5/16 in. thick by 1 in. wide
Operation--A. Make bottom nearly flat
B. Make bottom somewhat rounding
Pressure--A. 22,300 lb.
B. 8,000 lb.



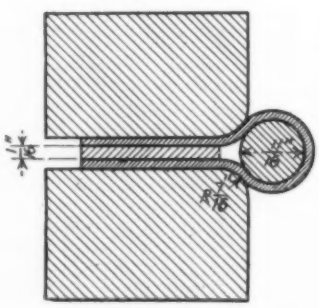

Material--Soft steel, 1/8 in. thick by 1 in. wide
Operation--Form as shown, bottom about flat
Pressure--6,000 lb.



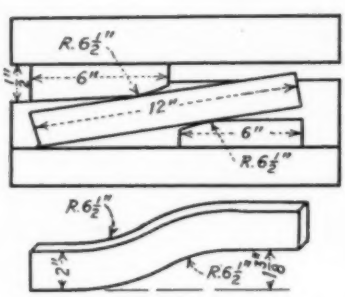

Material--Sheet steel, 0.100 in. thick by 3 in. wide
Operation--Form as shown
Pressure--Total - 11 tons; 5 tons to hold; 6 tons to draw



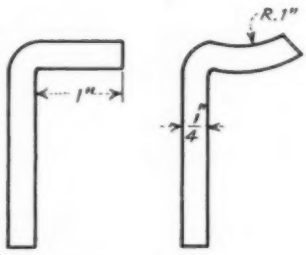

Material--Annealed steel, 0.109 in. thick by 5-1/4 in. wide, by 6 in. long
Operation--Form a U-shaped piece
Pressure--31,000 lb.



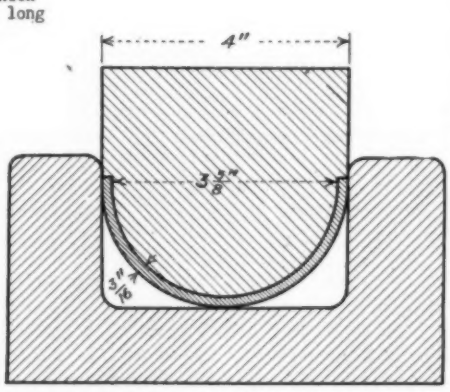

Material--Annealed steel, 0.109 in. thick by 5-1/4 in. wide by 6 in. long
Operation--Piece shown above has the ends brought together
Pressure--19,000 lb.




Material--Machine steel, 1/2 in. thick by 2 in. wide
Operation--Form cold
Pressure--100,000 lb.




Material--Cold-rolled steel
A. 1/4x1 in.
B. 1/4x6-1/2 in.
Operation--Form a curve in one end of an angle
Pressure--A. 15 tons B. 97-1/2 tons



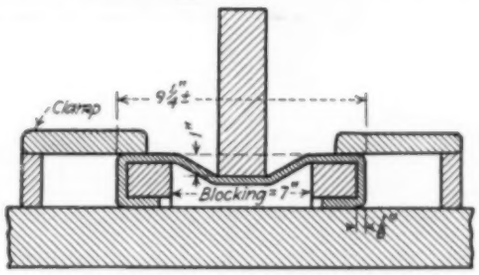

Material--Cold-rolled machine steel, 3/16 in. thick, 3 in. wide, 6-1/4 in. long
Operation--Form a U-shaped piece
Pressure--2,200 lb.

*Contributed by C. W. LUCAS* © *American Machinist*

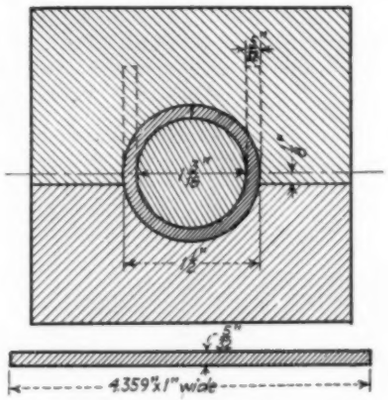
# Press Work Pressures

## Series XXIII—*Forming*

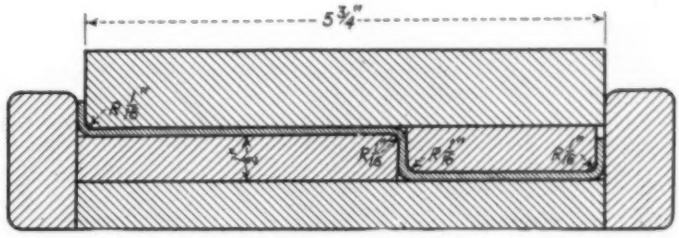
Material--Galvanized iron, 0.0625 in. thick
Operation--Form as shown
Pressure--65,000 lb. Tested on a hydraulic press



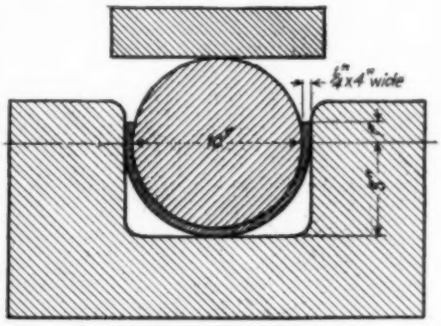

Material--Machine steel, 1/8 in. thick by 1-1/2 in. wide
Operation--Form a corrugation
Pressure--7,400 lb.



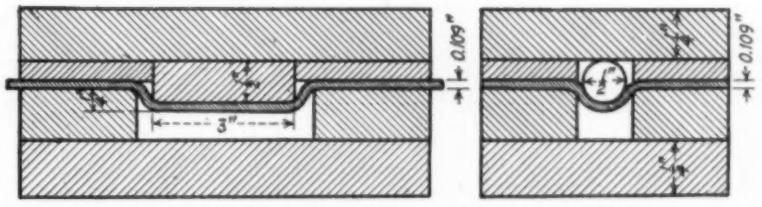

Material--Machine steel, 5/32 in. thick, 1 in. wide, 4.359 in. long
Operation--Form a U-shape to a circle
Pressure--50,000 lb.



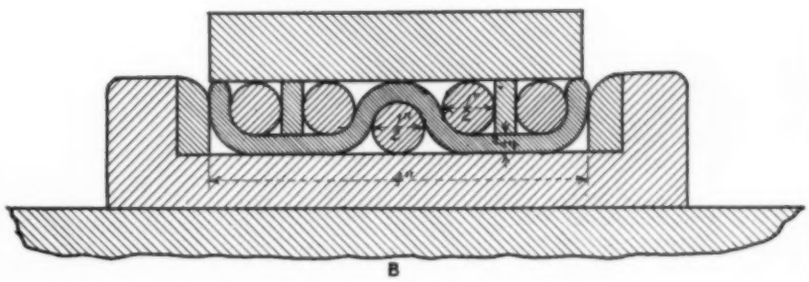

Material--Sheet steel (soft), 1/16 in. thick by 3 in. wide
Operation--Form as shown
Pressure--30,000 lb.



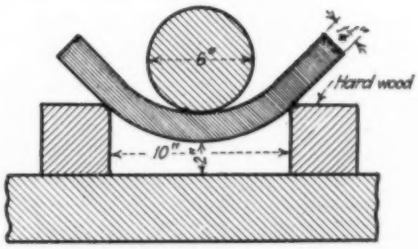

Material--Machine steel, 1/4 in. thick by 4 in. wide
Operation--Form cold
Pressure--5,000 lb.




Material--Sheet machine steel, 0.109 in. thick
Operation--Form a bead 3 in. long
Pressure--30,000 lb.




Material--Machine steel 1/4 in. by 1 in.
Operation--A. Form without the ends turned up
B. Form with ends curved
Pressure--A. 24,000 lb.
B. 40,000 lb.




Material--Black pipe, 1-1/4 in. in diameter
Operation--Bend pipe
Pressure--4,600 lb.

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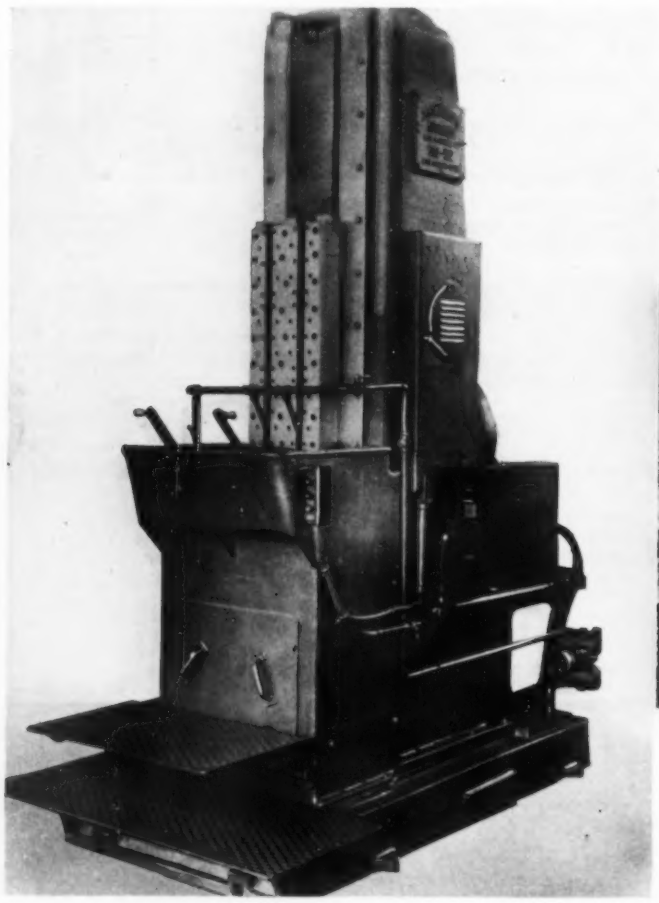
# SHOP EQUIPMENT NEWS

## American Vertical Mechanical Surface Broaching Machine

Among recent developments in external surface broaching machines by the American Broach & Machine Co., Ann Arbor, Mich., is the vertical mechanical surface broaching machine illustrated in Fig. 1. This machine is set up for broaching two flats on each end of a front shackle pin, Fig. 2, to be used on one of the new axleless cars. In machining this part it is essential that the flat surfaces be parallel within 0.001 in. lengthwise of the pin as well as at right angles to the pin. The machine is driven by a worm gear and then through a helical pinion and rack, and has a stroke sufficient to operate broaches up to 44 in. in length. The broaches used for the operation mentioned were approximately 3 ft. long and consisted of three sections per broach. They are so made that when the finishing ends are worn they can be reground and moved down into the second section and when worn undersize for that position can be reground and moved into the first position.

Fig. 3 shows the position of the broaches in the broach holder. Eight broaches are used for broaching the eight flat surfaces on two pins, each pin having four flat surfaces. All broaches are mounted in the holder and the sections are held in place by means of screws. Pressure is taken by plates on top of the broach holder.

Fig. 4 shows the fixture employed which is of the plier type, operated and



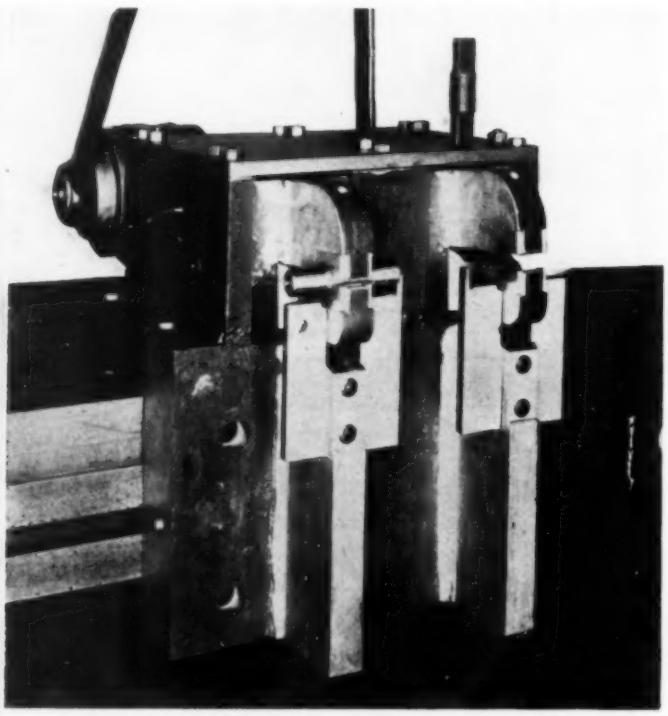
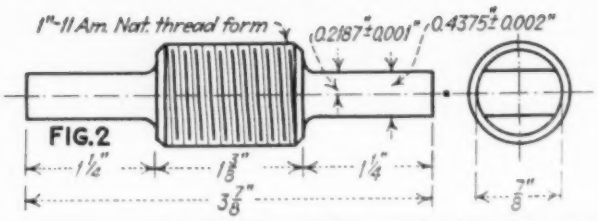


**Fig. 1—American Vertical Mechanical Surface Broaching Machine with pulling capacity of 18 tons. This machine is set-up for producing 300 front shackle pins per hour. Fig. 4—Plier-type fixture used for holding two shackle pins**



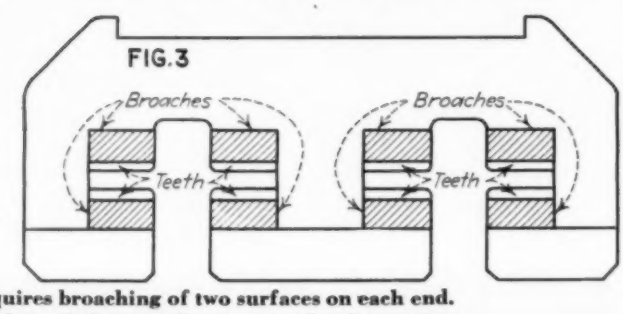




**Fig. 2—Threaded front shackle pin which requires broaching of two surfaces on each end.**
**Fig. 3—Broach holder for eight broaches to broach four surfaces on each of two pins**

locked by means of a cam-locking device. This device puts considerable pressure on the pin to prevent it from turning. One pin is shown in place with the lever moved into locking position. The other side of the fixture is open and ready to receive the work.

When a pin is placed in the fixture and the lever moved to lock it, the holding jaws rock, allowing the pin to move down so that both ends rest on a hardened and ground support. A finger positions the pin lengthwise. On the fixture proper, just below the hardened support, is a series of small holes through which lubricant is forced for the purpose of washing chips away as the broach passes on the cutting as well as the return stroke. After the two pins are placed in the fixture, the machine is started by means of a starting button, the broach passes down over the work, the slide comes to a stop, the work is removed, and the pushbutton for the return stroke is operated. A production of 300 pins per hour is obtained.

Specifications of surface broaching machine: Motor required, 25 hp., 1,200 r.p.m.; pulling capacity, 18 tons; height of machine, 136 in.; weight, 10,600 lb.; floor space, 38 x 104 in.

**Fig. 2—Uniform feeding of the wheel under all conditions, assuring even wheel pressure and elimination of feed marks marring the work, is brought about by the Heald hydraulic cross feed**

# Heald Improved No. 81 Internal Grinder

Important improvements in flexibility and ease of handling have been made in the No. 81 small internal grinder by the Heald Machine Co., Worcester, Mass. Features of the improved design are: separate motor drive to workhead, hydraulic actuation of the fixture operating mechanism, V-belt drive from the motor to the wheelhead idler shaft, improved switch box with concealed line switch, heavier base with improved rear shaft and water tank mounting, and hydraulic cross feed with automatic retraction.

A separate motor drive for the workhead has been standardized, making it convenient to grind either straight or tapered work. Drive to the spindle is by means of a flat belt and an adjustable idler to take up slack. A.c. or d.c., single or multiple-speed motors can be fitted. The maximum angle to which the workhead may be swiveled is 30 deg.

Although hydraulically actuated, the fixture operating mechanism is similar in construction to that previously furnished. As before, it is available in three types: Standard pull type, push type, and a special type for diaphragm fixtures. All three types are now actuated by a small hydraulic cylinder mounted on the back of the workhead and bearing against a lever on the end of the fixture operating shaft. A hydraulic valve for the fixture operation is mounted on the front of the machine, but the fixture can be operated manually when the motor is not running. The workhead clutch is operated by a hydraulic cylinder controlled by the table, in place of the cam previously used.

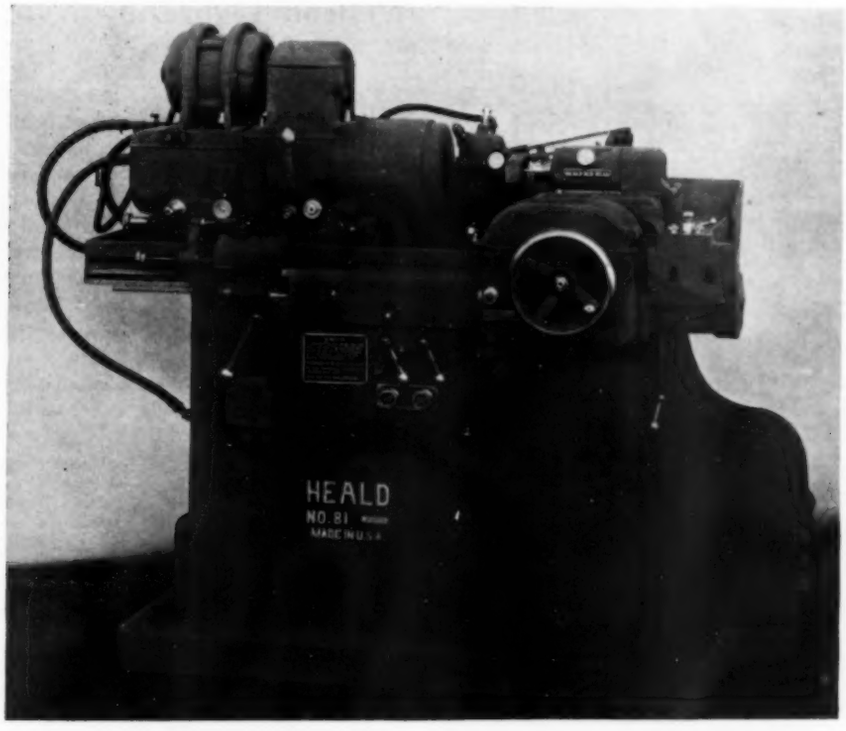



**Fig. 1—Separate motor drive for the workhead and hydraulic cross feed with automatic retraction are features of the Heald Improved No. 81 Small Internal Grinder**

Controls have been changed only in detail. A knob has been added for regulating the spring tension on the gages. A taper adjustment for the workhead operating by means of opposed screws works on the same principle as that on the No. 72A Gagematic.

The cross-slide is hydraulically operated. With this arrangement the right speed to the table and feed to the wheel can be obtained without one being dependent on the other. The hydraulic feed also eliminates the usual gears, pawls and other mechanisms that are likely to wear, and makes possible four feed adjustments. There are six distinct functions performed by the cross-slide during the grinding cycle. These include a pick-up feed as the wheel enters the hole and roughing feed set for as many passes of the wheel as needed when it drops to a fine feed. As the wheel with-

draws for truing all feed is stopped. When the hole approaches the final size practically all the feed is cut off and a spark out feed is obtained. Finally, as the wheel withdraws from the hole it is backed off ready for a new piece of work. Constant working pressure is maintained at the feed valves irrespective of the changes in the line pressure by a reducing valve through which the high oil pressure is reduced to a constant low pressure.

The No. 81 machine is fully automatic with the exception of loading the work and setting the grinding cycle. It can be arranged to size the work Size-matically or Gage-matically, or if desired, a combination of the two methods. Primarily, the machine is designed for small work, the maximum length ground being 3 in., and the maximum diameter 1 in.

## American Special Pull-Broaching Machine

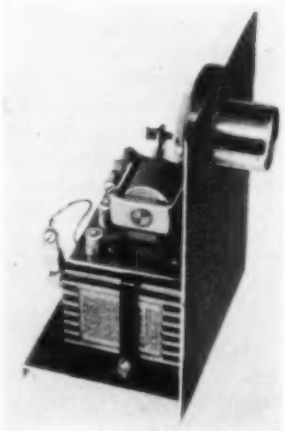
The American Broach & Machine Co., Ann Arbor, Mich., furnished to the contractor for the penstocks at Boulder Dam a special pull-broaching machine used in the assembly of the penstock section. It was designed for the purpose of pull-broaching the hole in the outer band and the tube proper at each joint. Immediately after the broach is pulled through an adaptor head is slipped into the pull chuck and a rivet is placed in the head and pressed into place at a pressure of 40 tons.

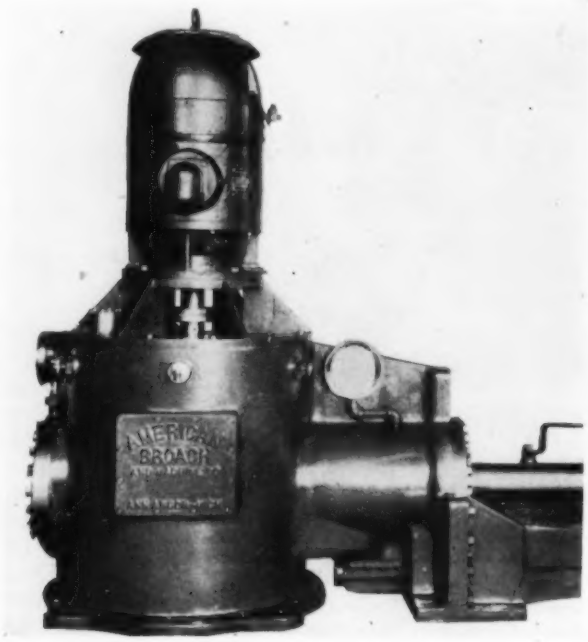
The machine is shown mounted on a moveable table that is in turn carried on a carriage movable lengthwise in the tube. A turntable on the carriage carries the broaching unit and a drilling unit. These two units are turned in different positions for drilling and broaching the various number of holes required in the circumference of the work.

The broaching and pressing unit has a capacity for pulling up to 35 tons and pushing up to 40 tons. The total weight of the machine is approximately 5,400 lb. without the motor.

## Rhamstine "Electric Eye"

J. Thos. Rhamstine, 508 E. Woodbridge St., Detroit, Mich., is marketing an inexpensive "Electric Eye," or photo-electric relay equipment. This equipment employs a dry-disk photocell, a small battery and inexpensive relay with accessible adjustment. It provides the basic unit for simple set-ups to control articles on assembly lines and to control machines. With the use of an auxiliary relay the "Electric Eye" can be adapted to the operation of equipment requiring considerable power.






**Pull broaching rivet holes in the stiffening band and the heavy penstock piping (Boulder Dam) is done with this American Special Pull-Broaching Machine**

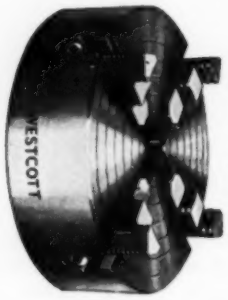
## Marble-Card Single-Phase Capacitor Motors

The Marble-Card Electric Co., Gladstone, Mich., is building a line of single-phase capacitor motors which are similar in construction to a two-phase squirrel

cage motor with a condenser connected across one phase for starting, the condenser being cut out automatically by a contactor when the motor comes up to speed. The condenser and contactor are mounted in a sheet-metal starting unit, as shown in the accompanying illustration. The characteristics of these motors are high starting torque, efficiency and power factor.

## Westcott Light-Duty I.X.L. Lathe Chuck

The Westcott Chuck Co., 324 E. Walnut St., Oneida, N. Y., is now manufacturing a light-duty I.X.L. independent lathe chuck for use on so-called light duty lathes of all kinds. The body of the chuck is made in one piece and of high-strength, close-grain nickel iron. Jaws are of a special case-hardening steel. They are hand fitted to the chuck and have raised and ground steps. When mounted on a true spindle with a true adapter, these steps show a longitudinal run-out of less than 0.001 in. The long end of each jaw is serrated so that when the jaws are reversed they will grip bars.



Jaw screws are threaded full length except where they are necked for the bearings, and they have mortised heads to take a square-end T-handle wrench. Nickel steel is used for the heat-treated thrust bearings which are fitted tightly into the chuck body. Sizes of the chuck now available include 3, 4, 5, and 6 in., all with four reversible jaws.

## Redin No. 100 Sensitive Drilling Machine

A four-speed, rolling-wedge transmission is used in the No. 100 sensitive drill built by A. W. Redin & Son Machine Co., 1846 Eighteenth Ave., Rockford, Ill. This transmission consists of a motor pulley and a spindle cone pulley with a non-metallic idler held up against the two by means of a light spring. The idler pulley is wedged in between the two pulleys only when resistance is applied to the spindle. Shifting from one speed to another is done by pushing the shift lever to the rear and then up or down. The shift comb is located on the outside of the machine. A brake handle on the outside of the transmission housing eliminates necessity for grabbing the revolving chuck for quick stopping.

Ball bearings are used throughout the entire spindle assembly. The spindle and sleeve assembly are counter balanced. Banks of two to eight heads can be assembled at 9½ in. centers on a ground surface base for production drilling.

Specifications: drilling capacity, 0 to ½ in., spindle travel, 2 in.; spindle to column, 6 in.; table to chuck, maximum, 8 in., minimum 1 in.; table size, 9 x 12 in.; weight, 150 lb.; motor, ⅓ hp.

**Speed changes of the Redin Sensitive Drill can be made while motor is running or stopped by means of this roller-wedge transmission**

## Oxweld "Pantosec" Precision Shape-Cutting Machine

The Linde Air Products Co., 30 East 42nd St., New York, N. Y. is introducing the "Pantosec" precision shape-cutting machine which is suitable for cutting dies, cams and other parts. The cutting range is 44 in. longitudinally and 20 in. laterally. Straight-line cutting, angle cutting, beveling, circle cutting and intricate shape-cutting can be done. Floor space is approximately 72 x 83 in.

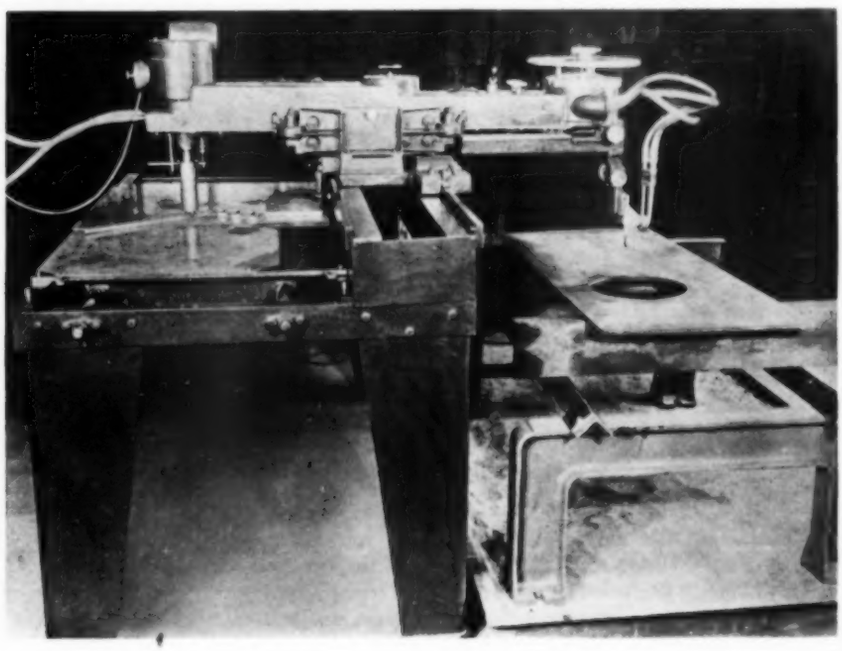
The Pantosec can be operated from either the templet end or the blowpipe end, and as a hand-guided or machine-guided instrument. Angles can be cut without templates since the cutting head can be locked for travel in any direction. The dividing head enables the operator to set stops on work that is to be cut in several directions. An extension has been mounted so as to make it unnecessary for the operator to return to the back to start the profile cutting after the entry cut has been made. The machine consists of a carriage mounted on three-point supports. Piping for the gases is inclosed in the carriage and drives are protected by dirt-proof casings.

## "Super Manga" Iron

The Robins Conveying Belt Co., 15 Park Row, New York, N. Y., is now offering "Super Manga" nickel-chromium cast-iron for abrasion-resisting applications. This alloy iron has a martensitic structure with a refined carbide network which contributes to its uniform hardness, strength and toughness. A chilled surface will show a Brinell hardness of 600-750 and chill depth can be controlled and a tough grey core provided. Material may be sand cast to possess a solid white structure with Brinell hardness ranging from 475 to 625. Heat-treatment is recommended for applications involving impact or alternating stresses. Wear tests are said to have shown a life two to twelve times longer for Super Manga iron than for plain chilled iron.

## "Bonis" Die Coatings and Mold Dressings

The St. John X-Ray Service, Inc., 30-20 Thomson Ave., Long Island City, N. Y., is now introducing a line of "Bonis" die coatings and mold dressings for die-casting dies and permanent molds for non-ferrous metals. These materials are applied under air pressure over the hot dies or molds and are said to fill the pores and fine cracks. As a result cast-



ings have a smooth surface appearance and a good finish. The Bonis materials act as an insulator as well as a lubricant. One application will last for 300 shots in die casting machines.

## Racine Improved Hydraulic Shear-Cut Production Saws

A number of improvements and changes in its line of hydraulic shear-cut production saws has been made by the Racine Tool & Machine Co., Racine, Wis. These machines are now manufactured in a larger range of sizes as follows: 10 x 10 in., 12 x 12 in., and 10 x 16 in., as well as in special sizes of 13 x 13 in., and 13 x 16 in.

The saw guide and saw frame now slide in ways which extend on each side of the frame. Thus, the frame is widely supported on each side instead of on the top surface only. Adjustment is provided by means of two gibs on each lower bearing surface and by one side gib. The connection between the saw guide and the main hydraulic cylinder is now accomplished by means of two tension rods on each side of the frame, these rods extending down through the table and being attached to the piston rods by means of a cross member. As a consequence, the hydraulic feeding pressure is now applied directly under the center of the blade. The saw frame is also of different construction, now having the ways bolted entirely through the frame on each side. This construction makes possible heavy tension of the blade. Distortion of the frame does not affect the accuracy or alignment of the side plates. The Racine hydraulic pumping unit is now located inside of the oil reservoir and runs in the oil. The variable volume feature of the pump as well as the pressure is controlled by an automatic hydraulic governor device.

## "Printweigh" Figured Type Scale

Printed weight records are provided by the "Figured Type" Printweigh scale announced by the Toledo Scale Company, Toledo, Ohio. The printing device can be furnished on dial scales of 62½ to 10,000 lb. capacity and can be attached to any late model Toledo scale of similar capacity. The device automatically and mechanically selects and prints the correct weight figure. It prints in $\frac{1}{10}$ of a sec. at the touch of a button. An inserted ticket, a continuous strip or both can be used for the printed record.

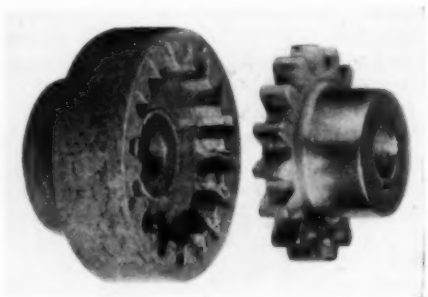
## "American" Detachable Broach Shank

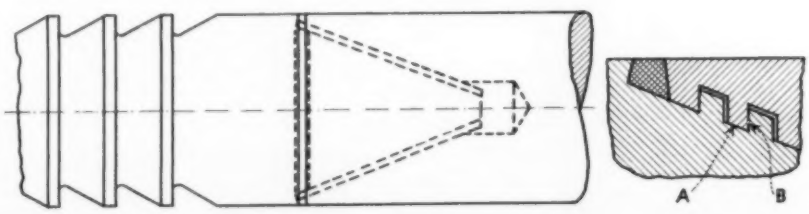
The detachable broach shank made by the American Broach & Machine Co., Ann Arbor, Mich., can be removed and placed on another when the broach wears. Even with a small broach the saving in the cost of tool steel is considerable, and is multiplied rapidly when it is considered that each detachable shank is good for use with one to two dozen broaches. The shank can be supplied in various sizes to fit broach shanks ¾ in. in diameter and larger. It can be made with any type of pulling connection; that is, with a slot for the usual puller key, two flats, and with a circular groove.

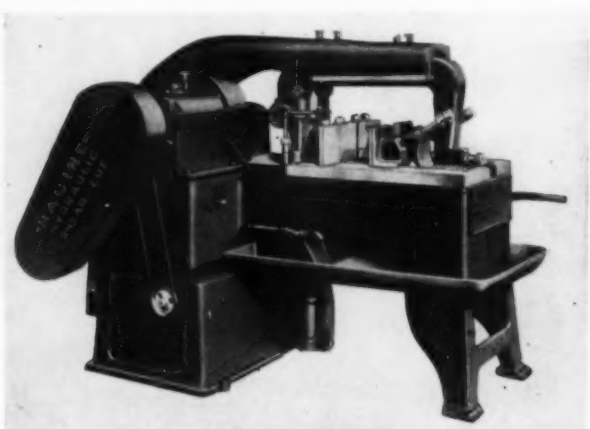
The accompanying illustration shows the manner of connecting the detachable broach shank to the broach. The threaded portion is a steep taper and the bottom surface of the thread is on the same angle or taper as the O.D., causing the two surfaces at *A* to center themselves. The angle of the surfaces *A* throws the load against the pulling side of the thread *B*.

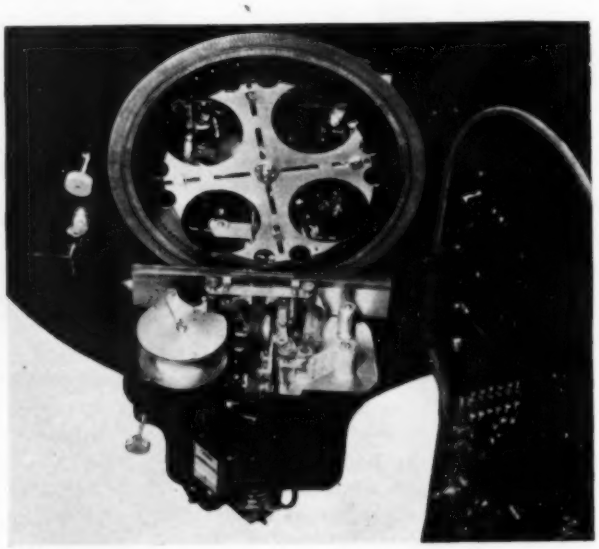
## "Celoron" Sprocket Coupling

Continental - Diamond Fibre Co., Bridgeport, Pa., is introducing a sprocket coupling having the female end molded of "Celoron" and the other half a steel sprocket. The outside of the coupling is smooth when assembled. There are no distinct points of wear as the design insures an equal distribution of the load. Seven standard sizes are built, each one of which is designed to cover a wide range of horsepower output. The No. 1 coupling, for example,







**Above—Racine Saw with stronger saw frame and double slide ways for more rigid support to the blade. Right—The Printweigh Figured-Type Scale automatically prints the correct weight**

can be used on ½- to 4-hp. drives at speeds from 100 to 6,500 r.p.m., whereas No. 7 can be used on drives from 20 to 85 hp. at speeds from 100 to 2,500 r.p.m.

## Stonhard Rustproofer Compound

A transparent compound having rust-arresting and rust-preventing properties has been developed by the Stonhard Company, 401 North Broad St., Philadelphia, Pa. This rustproofer compound contains materials that neutralize existing rust or rusting agents present in rust and in the pores of the base metal. The compound also provides a moisture-proof and air-tight film to maintain this passive condition. Upon drying the material eventually becomes hard and dry on the surface, but retains tackiness next to the metal which prevents it from being affected by atmospheric changes, temperature extremes and vibration. Any kind of paint or regular enamels may be applied directly to the rust-proofer as a wear coating.

# Société Genevoise Type MP-6B Jig Borer

A jig borer capable of locating, drilling and boring holes in the top and all sides of a box jig as large as 59x40x32 in. in size is the product of the Société Genevoise d'Instruments de Physique, Geneva, Switzerland, for which the R. Y. Ferner Co., Investment Bldg., Washington, D. C., is the American agent. This machine is designated as Model MP-6B.

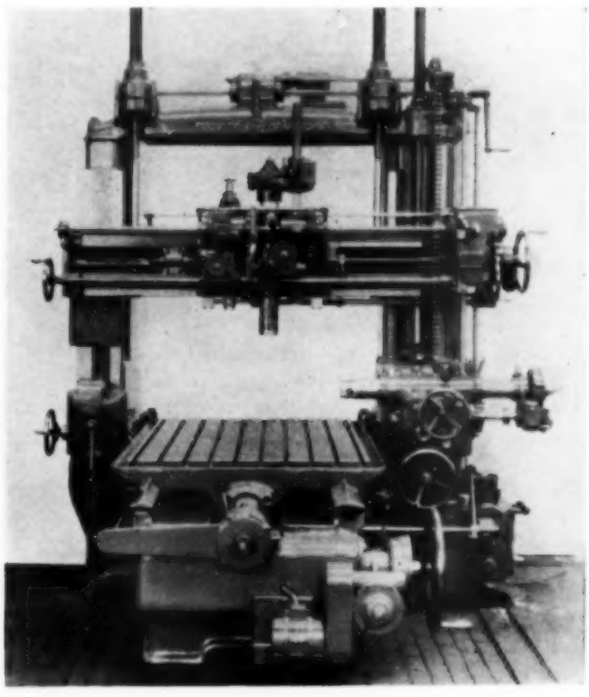
The machine has a horizontal spindle as well as two vertical spindles. One of the latter is a high-speed head for the drilling and boring of the smaller holes. The horizontal boring head is mounted on the right column and is counterbalanced. The spindle has nine speeds, varying from 48 to 420 r.p.m., and three rates of power feed. Total feed is 12 inches. The boring head is raised from 8 in. above the table to 28½ in. by means of a 2-in. vertical leadscrew, which is read by micrometer head and vernier to 1/20000 in., as are the other two leadscrews of the machine. All three leadscrews are automatically compensated for error in a similar manner to the other "GSIP" jig borers, by means of compensating templets which cause a small shift of the vernier indexes back and forth as the screw is rotated, to allow for the errors.

The use of the horizontal head is extended by use of a long boring bar, which can be mounted in the spindle and is guided at the opposite end by a bearing on the left side of the machine. This bearing is adjusted for height, so that its axis is in line with that of the spindle, by a device which includes an eyepiece to be mounted in the bearing and a mirror to be mounted in the spindle. A beam of light is thrown into the eyepiece from the side and illuminates the lines of a glass reticle in the focus of the ocular. An image of these lines of the glass reticle is reflected from the mirror in the spindle which is mounted strictly perpendicular to the spindle's axis. The bearing is raised or lowered until the image of the horizontal line coincides with the line itself.

A circular table of 31½ in. diameter, and of special construction to carry heavy loads and take up the side thrust of boring, provides further for greater use of the horizontal boring head, in that box jigs can be mounted on it and rotated to present all four sides to the drill and boring tool. This circular table rolls on steel balls, and is provided with a disk clamp which effectively holds the surface of the table against any tilting from the side thrust of boring. This table has a worm screw with micrometer head and vernier to read the angular rotation to 1 second of arc. The table is 8 in. high and weighs 1000 lb.

A cross-rail carries the two vertical spindles and is provided with a leadscrew to move them 40 in. across the table. The rail can be raised from 16 in. above the table to 36½ in. above it. The main spindle has 10 in. feed but the same speeds and rates of feed as the horizontal spindle. Both have a No. 4 Morse taper, and draw-in rods are used to hold tools and fixtures in the spindles. The high-speed spindle is 8 in. from the main vertical spindle and parallel to it and the same distance from the cross-rail, so it is a simple matter to change from one vertical spindle to the other by merely allowing for 8 in. difference of position. It has a No. 2 Morse taper, a range of speeds from 140 to 1,250 r.p.m. and 4 in. feed. All three spindles have separate automatic oil pumps for lubrication.

The drilling capacity of the two larger spindles in cast iron is 2 in., boring capacity, 6 in. The accuracy of all settings of the leadscrews is guaranteed to 0.0005 in. The leadscrew of the rectangular table provides for 52 in. movement. The table itself is 59 in. long and 40½ in. wide, but the width of the space between the vertical columns is 55 in., so that very large rectangular pieces and specially large circular pieces can be accommodated on the machine.



**Box jigs can be mounted on the circular table and rotated for boring and drilling on all four sides. The Société Genevoise Type MP-6B Jig Borer has a horizontal and two vertical spindles**

## Brown Mercury-Switch Thermometer Controller

The use of mercury switches to eliminate open make-and-break contacts controlled by the pen arm is a feature of the automatic control thermometer an-

**Brown Mercury-Switch Thermometer Controller**

**Records and Controls Temperatures up to 1200° F.**
(a) Knob for changing setting of B. (b) Index showing temperature at which control is set. (c) Temperature pen. (d) Electric motor selects switch position, depending upon relation of C to B. (e) Mercury in glass switches, capacity 15 amperes at 110 volts, positive in action, are mechanically positioned by motor D. No power required from pen. Eliminate relays in most applications.

nounced by The Brown Instrument Co., Philadelphia, Pa. Every six seconds a motor-driven control table determines the location of the pen on the chart in reference to the control setting, and tilts the mercury switch from one side to the other if the temperature has changed. With this system the measuring mechanism is free to position itself unhampered by the control mechanism. Corrosion and dirty contacts are eliminated because the switch is sealed in glass. This control mechanism is adaptable to one-, two- and three-contact control or signaling systems. The controller is also supplied as a time-temperature cycle controller. All models are furnished in circular 10-in. or 14-in. dustproof cases.

## Mattison No. 424 Internal Tube Grinder

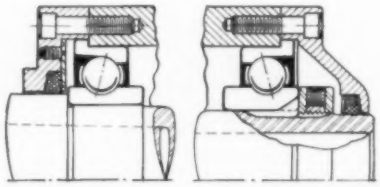
Internal grinding of tubes and pipes is done with a flexible, coated abrasive belt on the No. 424 tube grinder introduced by the Mattison Machine Works, Rockford, Ill. The abrasive belt travels around pulleys and through the tube at a high rate of speed. Supporting and driving rolls hold the tube in place and revolve it during the grinding process.

The abrasive belt is threaded through the tube and made endless by a special splicing tape. The splice is quick-setting and also can be released for removing the belt and resetting it again in the next tube. Grinding pressure is secured by means of a pneumatic head attached to a hollow ramrod. Air pressure passes through the rod into the expansible head, causing it to exert the desired pressure against the belt. Pressure is regulated by a control valve. The ramrod is power driven in both directions and has automatic reverse, thus causing the grinding head to move forward and backward through the tube. A water spray is incorporated for cooling the tube and for permitting fast cutting.

Finish is determined by grade of abrasive grits used. Since the cut is in a longitudinal direction only, there are no cross scratches around the inner surface. The machine can be supplied in ranges to handle tubes ½ in. internal diameter and up and of practically any length.

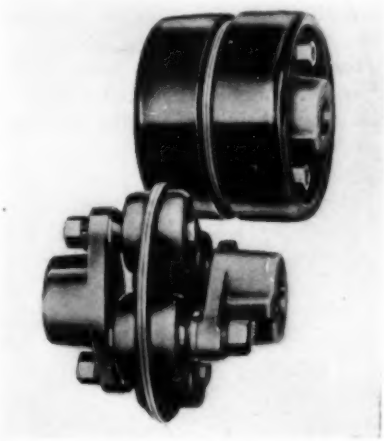
## New Departure Flanged Precision Spindle Bearings

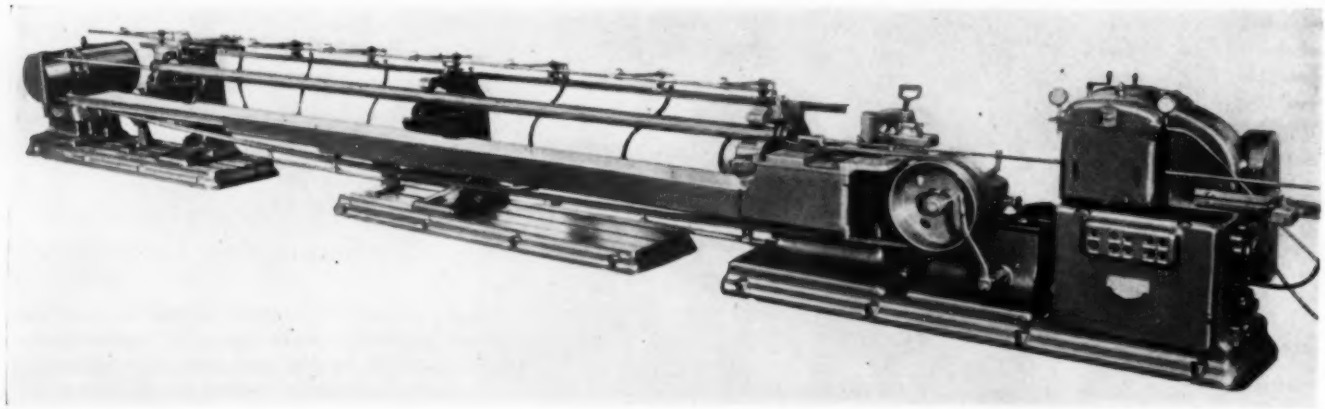
The New Departure Manufacturing Co., Bristol, Conn., has announced a line of flanged precision spindle bearings with the following features: The shoulders are on the bearing instead of in the housings; it is possible to bore housings straight through at one set-up, thereby assuring alignment; the bearings are separable for quick and easy assembly; inner rings are extra wide to assure non-deflecting seating and are key-slotted so that they may be locked to prevent creeping about the shaft, and preload is applied through the inner rings. These bearings are supplied in sizes from 30 to 130 mm. bore, to precision specifications, and are obtainable in two bore sizes for each standard outside diameter.



## "Morflex" Flexible Couplings

The Morse Chain Co., Ithaca, N. Y., and Detroit, Mich., division of the Borg-Warner Corp., is introducing the "Morflex" flexible coupling. The flexing member is a complete unit comprising four moulded, non-cold-flow, rubber trunnion blocks spaced 90 deg. apart and set under pressure into a two-piece riveted steel housing. The rubber trunnion blocks are provided with steel cores. Two diametrically opposite blocks are bolted respectively to the arms of the steel driving and driven flanges which are mounted on the shafts to be connected. The only contact between the two shafts is through the flexible rubber bushings or blocks. Flexing is entirely within the rubber. The coupling is said to need no protection from water, oil, dirt or grit, and requires no lubrication.





· AMERICAN MACHINIST ·

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• Boulder Dam is symbolical of the bigger and better everything that is decried by some as an American weakness, praised by others as a virtue. Quite in scale with the rest of this amazing project is the Babcock & Wilcox pipe welding plant which turns out welded steel pipe up to 30 ft. in diameter. Among the unusual pieces of equipment involved are the vertical bending rolls, the plate planer, the apparatus for 100 per cent X-ray inspection of welds, and the soaking pit. They are all described in the leading article.

• Procrastination is a poor gamble when a patent is involved. Even if the patent when finally granted has a later expiration date by reason of the delay the inventor takes a big chance that the details of his invention will leak out. How big the chance is is the subject of H. A. Toulmin's article.

• Concluding the article begun in the last number Fred H. Colvin gives further details of the operations on modern airplane propellers. Most of them have to do with hub and blade boring, the machining of the extremely resistant beryllium-bronze bushing, and balancing.

• Textile machinery builders have apparently benefited more from the Textile Code than from their own, although theirs is satisfactory enough. Our article, fourth of a series on machinery codes, reports the observations made during an extensive field study of actual conditions.

• Product costs as a basis for sales price is the subject of Charles H. Hatch's ninth article on cost-finding. With his customary practical approach Mr. Hatch shows two forms, one for parts cost and one for final product cost, and indicates how they may be adapted for various kinds of manufacture.

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## *Coming*

ARE the professorial experimenters to have their way and project us into a gigantic test of the industrial regimentation theory, or will the pendulum swing back again and restore most of our customary ways of conducting business? That is the question that is worrying every intelligent man in industry. Our leading article in the first January number will be built around this question by James W. Hook, president of the Geometric Tool Co., and for some months with the Industrial Advisory Board. Mr. Hook may not set down the final answer but his remarks will be helpful to those who have not had his opportunities to watch the Washington picture develop. Don't forget that the second January number is the Annual Shop Equipment Review. It will contain almost 700 descriptions of new machines and equipment.

NRA MEMBER U.S.
WE DO OUR PART

A FEW WEEKS AGO our companion publication, *Product Engineering*, concluded its annual survey of product developed activity. Written reports were received from subscribers who are officials and chief engineers of 362 typical plants manufacturing machinery and "engineered" metal products. They stated in detail the specific design improvements that they are trying to make. Below is a general summary of what they are doing (send for a copy of the complete report):

## PRODUCT DEVELOPMENT ACTIVITY

| | Per Cent |
|---|---|
| Companies continuing design activity undiminished | 46 |
| Companies planning increased product development work | 45* |
| Total | 91 |

*In last year's product development survey, this figure was 23 per cent. Thus practically twice as many companies are planning increased product development work in 1934 as in 1933.

## NEW PRODUCTS

| | Per Cent of Companies |
|---|---|
| Developing new products in *present* line* | 81 |
| Developing new products in a *new* line* | 29 |
| Brought out new products, or new models, in 1933 | 41 |

*Some companies are of course doing both.

## GENERAL AIMS IN DESIGN

| | Per Cent of Companies |
|---|---|
| Design for—higher price class | 29 |
| —lower price class | 39 |
| Redesign to reduce cost of manufacture | 32 |
| Design to provide more styles and sizes catering to individual tastes or needs | 41 |
| Simplifying the line of products, through fewer styles and sizes | 37 |
| Design to modify the range of use: | |
| —to widen the range | 55 |
| —to narrow the range | 4 |
| Design to reduce installation or erection cost | 26 |

## SPECIFIC DESIGN IMPROVEMENTS

| | Per Cent of Companies |
|---|---|
| Higher speeds | 43 |
| Larger and heavier machines | 19 |
| New functions | 43 |
| More automatic operations | 41 |
| Greater precision in use | 33 |
| Greater compactness | 45 |
| Built-in drive and control | 30 |
| Increased capacity or output | 48 |
| Increased efficiency | 64 |
| Decreased power consumption | 29 |
| Better gearing | 22 |
| Better electrical control and accessories | 32 |
| Better springs | 10 |
| Devices or materials to reduce noise or vibration | 33 |
| Better lubrication | 44 |
| Adoption of materials for: | |
| —High stresses | 31 |
| —High strength-weight ratio | 26 |
| —Resistance to: | |
| —corrosion | 45 |
| —wear, abrasion | 44 |
| —high temperature | 18 |
| —impact | 17 |
| —vibration | 29 |
| —fatigue | 30 |
| Adding improved lock-washers, lock-nuts, and other devices to prevent loosening of parts due to vibration | 27 |
| Closer manufacturing tolerances | 40 |
| Protective coatings for wear, corrosion, etc. | 32 |
| Fewer parts | 38 |
| Standardized parts | 24 |
| More easily replaceable unit assemblies | 49 |
| Restyling to give new form | 43 |
| Improved color scheme | 25 |
| Better surface finishes | 38 |
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# New Products - - - New Models

## bring new problems and opportunities to production men

This activity in new products is not just happening. It is being forced by economic conditions. Out-moded products simply will not be able to stand the competitive struggle of the next two or three years. The public always bestows its patronage on the "best product for the money."

Every design change revealed in this report, involves some change in manufacturing equipment or process. In this great amount of necessary retooling, buying of new machines and accessories for existing equipment, the production man has a big responsibility.

AMERICAN MACHINIST will, of course, continue to report and interpret the most modern and efficient equipment and methods, in its articles and advertisements.

AMERICAN MACHINIST
330 West 42nd Street, New York


## PARTS AND MATERIALS RECENTLY ADOPTED, AND CONTEMPLATED FOR ADOPTION

| Materials | Per Cent of Companies |
|---|---|
| Alloy cast iron | 36 |
| Alloy steels | 37 |
| Malleable iron | 9 |
| Wrought iron | 4 |
| Stainless steels | 44 |
| Aluminum, or its alloys | 38 |
| Copper-nickel alloys | 12 |
| Magnesium alloys | 8 |
| Copper | 8 |
| Brass | 11 |
| Bronze | 13 |
| Zinc | 4 |
| Rare metals | 1 |
| Laminated or "clad" metals | 11 |
| Surface-hardening materials | 15 |
| Fibre | 12 |
| Rubber | 17 |
| Cork | 10 |
| Glass | 3 |
| Porcelain | 5 |
| Wood, plywood, pressed wood | 7 |
| **Construction** | |
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| Die castings: | |
| —zinc | 9 |
| —aluminum | 11 |
| —lead | 1 |
| Pressed metal parts | 23 |
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| Welded construction | 42 |
| Molded parts | 18 |
| Rolled, drawn, extruded shapes | 21 |
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| Gasoline engine drive | 4 |
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| V-belts | 26 |
| Silent chain | 7 |
| Roller chain | 10 |
| Speed reducer | 14 |
| Flexible shafting | 3 |
| Universal joints | 6 |
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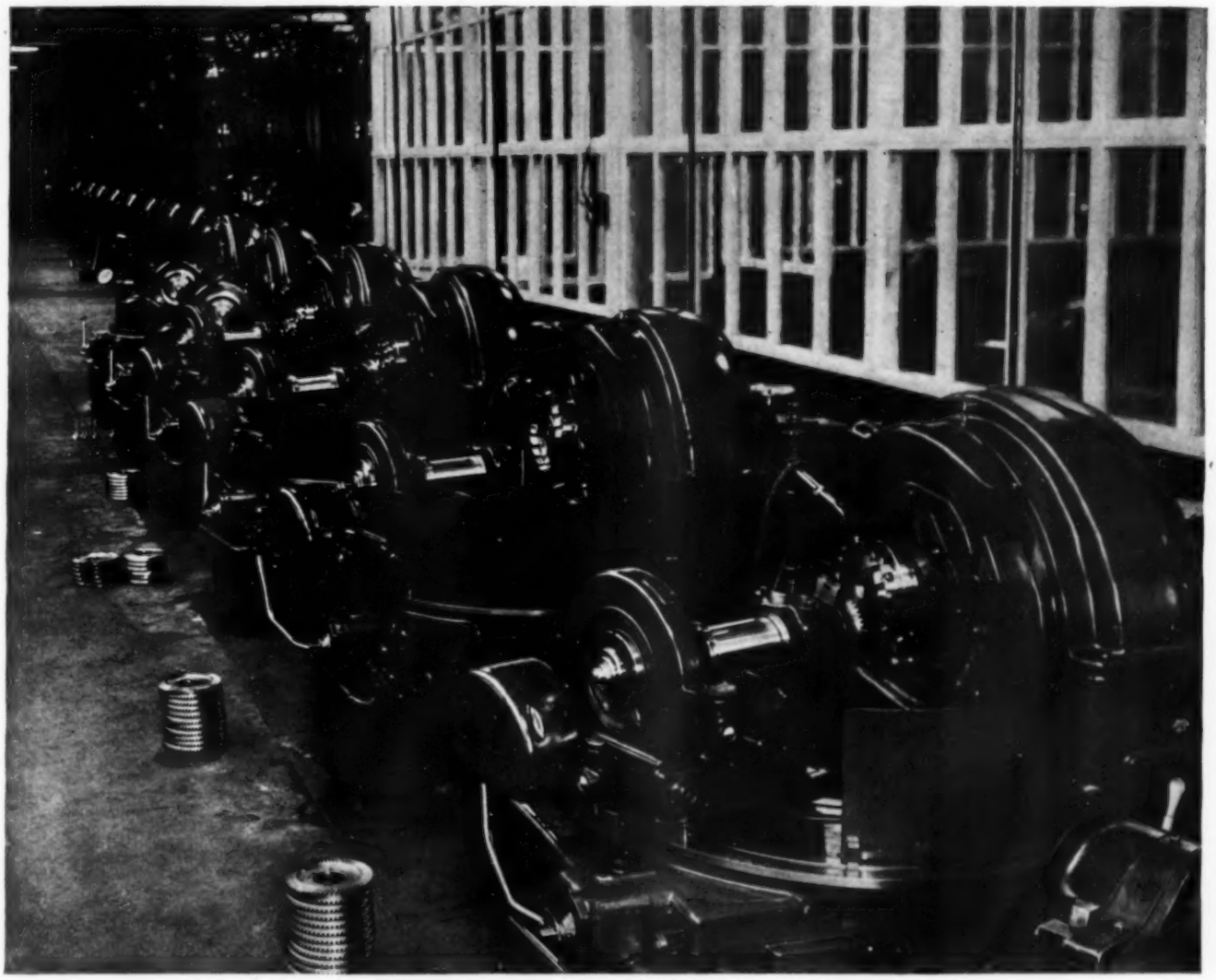
# NEW NO. *16* SPIRAL GENERATORS IN BRITISH PLANT



**THIS AUTOMOBILE MANUFACTURING COMPANY in BIRMINGHAM, ENGLAND quickly recognized the advantages of the new No. 16 SPIRAL BEVEL GEAR GENERATOR.**

**THE improvement in the quality of the gears cut, coupled with lowered production costs from the first machines, resulted in a repeat order for this battery.**

**YOU also can obtain higher quality and lower production costs. Send us your blueprints for production data.**

GLEASON

## GLEASON WORKS

*Builders of Bevel Gear Machinery for Over Sixty Years*

1000 UNIVERSITY AVENUE, ROCHESTER, N. Y., U. S. A.

# *Forty-one Years of Development*

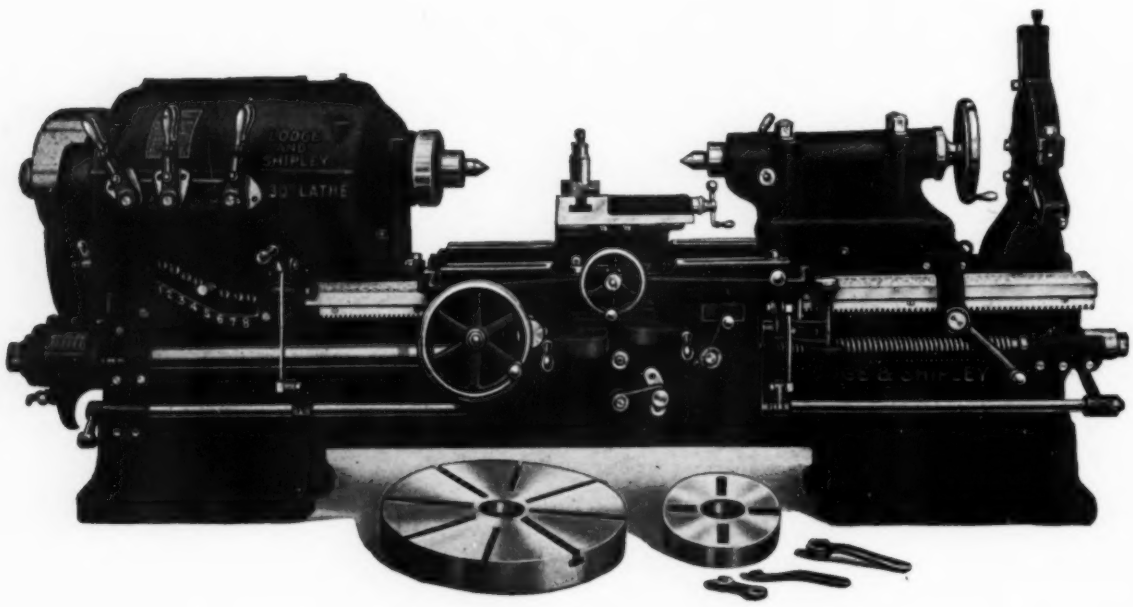
# LODGE & SHIPLEY ENGINE LATHES

When you glance back only a few short years you can see a big change in the industrial methods, not only in the equipment used but products manufactured.

Airplanes were considered wild flights of fancy and impractical—the Automobile industry was a mere babe in arms but Lodge & Shipley Engine Lathes were at that time recognized for their accurate workmanship and performance.

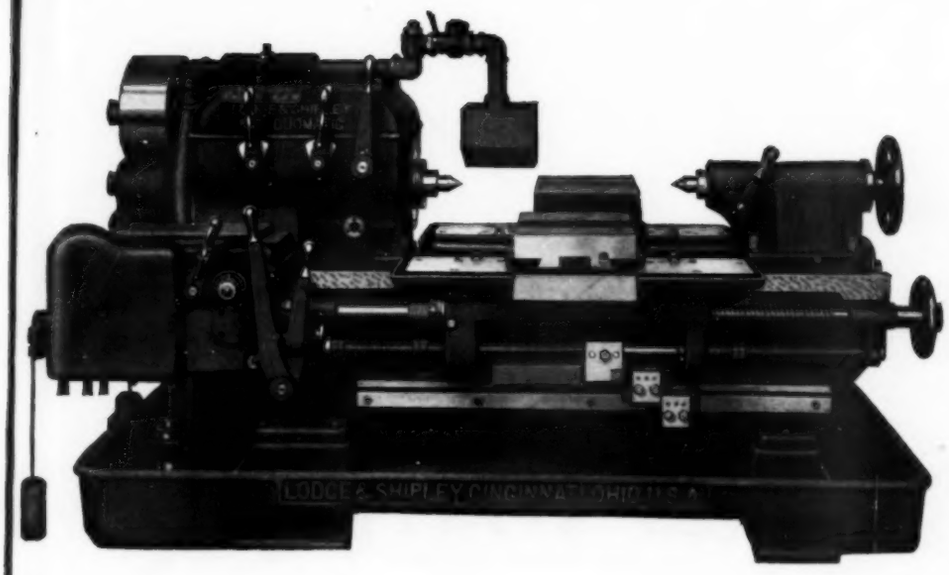
Lodge & Shipley design and construction has progressed with new developments and today represents the utmost in ease of control and continued accuracy.

LATHES
*Good Lathes Only*



## THE LODGE & SHIPLEY M

CINCINNATI, OHI




# *Production Costs are Lower on the* DUOMATIC

Ease of set-up and unusual possibilities for multiple tooling make this automatic lathe a profitable performer in the production line regardless of the size of the lot.

If you are not familiar with the possibilities of this high production machine, it will be to your advantage to investigate.

**MACHINE TOOL CO.**
**OHIO, U. S. A.**

A Merry and Happy
CINCINNATI

# Christmas a New Year!

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI GRINDERS INCORPORATED
CINCINNATI, OHIO, U. S. A.

# BE SURE IT'S THE BEST

EVERYBODY proclaims his product the best, but there is only one best which can live up to that claim.

THERE is, for example, only one die head which can show, on the basis of actual tests, the highest percentage of perfect work, the lowest spoilage, the largest production in a given length of time and the least final cost per screw of any die you can operate.

* * *

THE Jones & Lamson Tangent Die and Ground Thread Chasers lead the field in refinements of design and construction.

TODAY J&L die heads are picked to do the most difficult quality-quantity production jobs in such highly competitive fields as the automotive and aircraft industries.

## WHY?

JONES & LAMSON MACHINE C

# MAKE YOUR OWN TEST

INSPECTORS like J&L cut threads. Angle, crest and root are correct. Lead is guaranteed to Class 3 fit.

SHOP men like the saving of time, the ease of changing, sharpening and setting chasers. J&L chasers will reproduce on the first threads cut without loss of time or work.

HAVE you a threading job on which a cheaper die head is not yielding quality-quantity production at the lowest possible cost? If so, try a J&L Tangent Die —

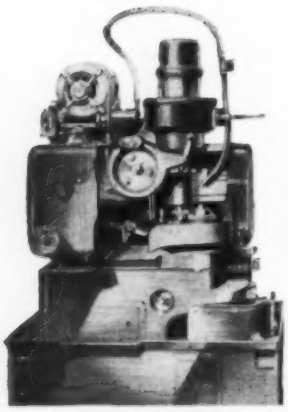
Make your own tests
Run your own work
On your own machine
Under the eyes of your own shop men

and

## COMPARE RESULTS

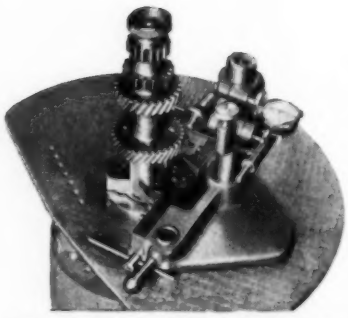
## COMPANY · Springfield · Vermont

# NOT ANY ONE MACHINE



THE FELLOWS
HIGH SPEED GEAR SHAPER

THE ORIGINAL
FELLOWS CUTTER

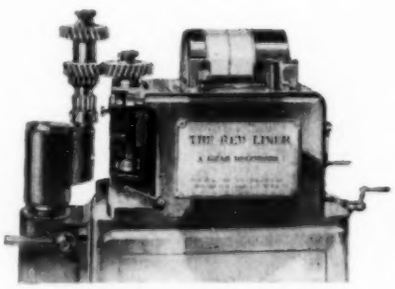


FELLOWS GEAR MEASURING
MACHINE

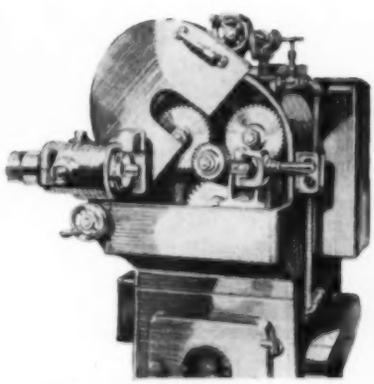
THE FELLOWS LINE INCLUDES: Four distinct sizes of GEAR SHAPERS, a complete line of GEAR SHAPER CUTTERS, two types of THREAD GENERATORS, HELICAL CUTTER SHARPENING MACHINE, RED LINER, GEAR MEASURING MACHINE, GEAR BURNISHING MACHINE, and GEAR and WORM LAPPING MACHINES, GEAR LAPS, BURNISHING GEARS, and MASTER GEARS — *Everything necessary for a complete gear manufacturing plant.*

# ...but a *METHOD*!

SO much depends on the proper balance of your gear production equipment that we urge you to consider the FELLOWS METHOD. This method provides a balanced setup which assures accurate gears at low cost. Successful gear cutting involves accurate production all along the line from the roughed-out gear blank to the finished product. For example: you cannot expect to secure the best possible results from Fellows Gear Lapping after hardening, unless the gears in the "green condition" have been accurately cut. Why not ask to have one of our engineers call and explain this highly successful gear cutting method --- there are no obligations attached. Write: THE FELLOWS GEAR SHAPER COMPANY, Springfield, Vermont (---or Detroit Office: 616 Fisher Building)



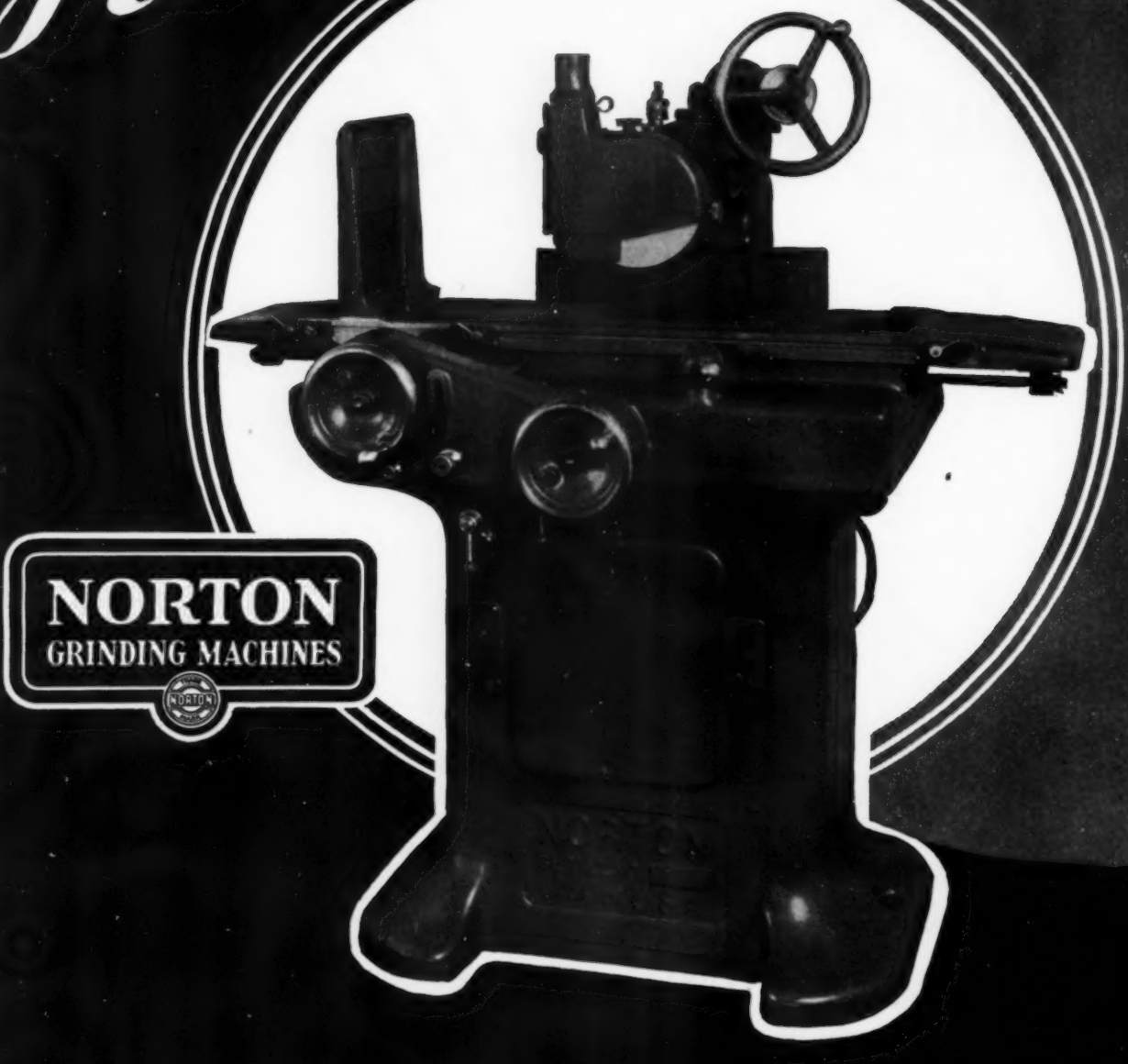
THE FELLOWS RED LINER



GEAR LAPPING MACHINE

FELLOWS
GEAR LAPPING
METHODS

# New Norton




## The 6 x 18" Hydraulic Surface Grinder

**Self-Contained** — **Reasonably Priced**

**Hydraulically Operated** — **Automatic Cross Feed**

**Cartridge-Type Spindle**—plain bronze or anti-friction bearings. Integral-spindle-and-motor type also available.

**Forced-Feed Lubrication** of Table Ways.

OTHER NEW NORTON MACHINES
The Type C Line of Cylindrical Grinders
The D-85 Crankpin Grinder

NORTON COMPANY

# Grinding Machines

## The No. 1 Universal Tool and Cutter Grinder

SEE THESE MACHINES AT:
THE MOTCH & MERRYWEATHER MACHINERY CO.
Cleveland Detroit Pittsburgh
THE MARSHALL & HUSCHART MACHINERY CO., Chicago

WORCESTER • MASS.

New Self-Contained Reasonably Priced

**Convenient**—can be operated from front, rear or either end.

**Cartridge-Type Wheel Spindle**—plain bronze, anti-friction or double taper bearings.

**Universal Work Head**—takes National Standard or B & S tapers—convertible to motor drive.

# LEADERS AGREE ON THESE

**BUSINESS**

*Quoting a Leader:*

"Every competitive business must keep out in front in methods and equipment in order to give consumers the lowest possible price."

J. Howard Pew
Pres. The Sun Oil Co.

**PRODUCTION**

*Quoting a Leader:*

"To meet new conditions . . . it is more necessary than ever that manufacturers rehabilitate their plants."

E. P. Bullard
Pres. The Bullard Company

**DESIGN**

*Quoting a Leader:*

"New lines are being created and old ones improved . . . Faster speeds, more economical production will feature the design successes of 1934."

A. L. DeLeeuw

M-R-C Strom SRB Gurney Ball Bearings

# Leadership will help you meet these new conditions

LEADERS in business, production and design, express the trend for 1934 as being toward lower manufacturing costs. Production economies can only be obtained through the use of highly modernized machines, not only more automatic in operation, but that run faster and turn out a better product at a lower cost.

These new production standards not only affect machine design, but greatly increase the importance of proper bearing selection and installation. Bearing development must keep pace with the latest trend in machine advancement; and the successful design engineer should be equipped with the latest ball bearing information.

The Marlin-Rockwell Corporation offers the wide experience of three pioneer ball bearing manufacturers and can supply practically every type of ball bearings required for the successful solution of modern shaft support problems.

**MARLIN-ROCKWELL CORPORATION**

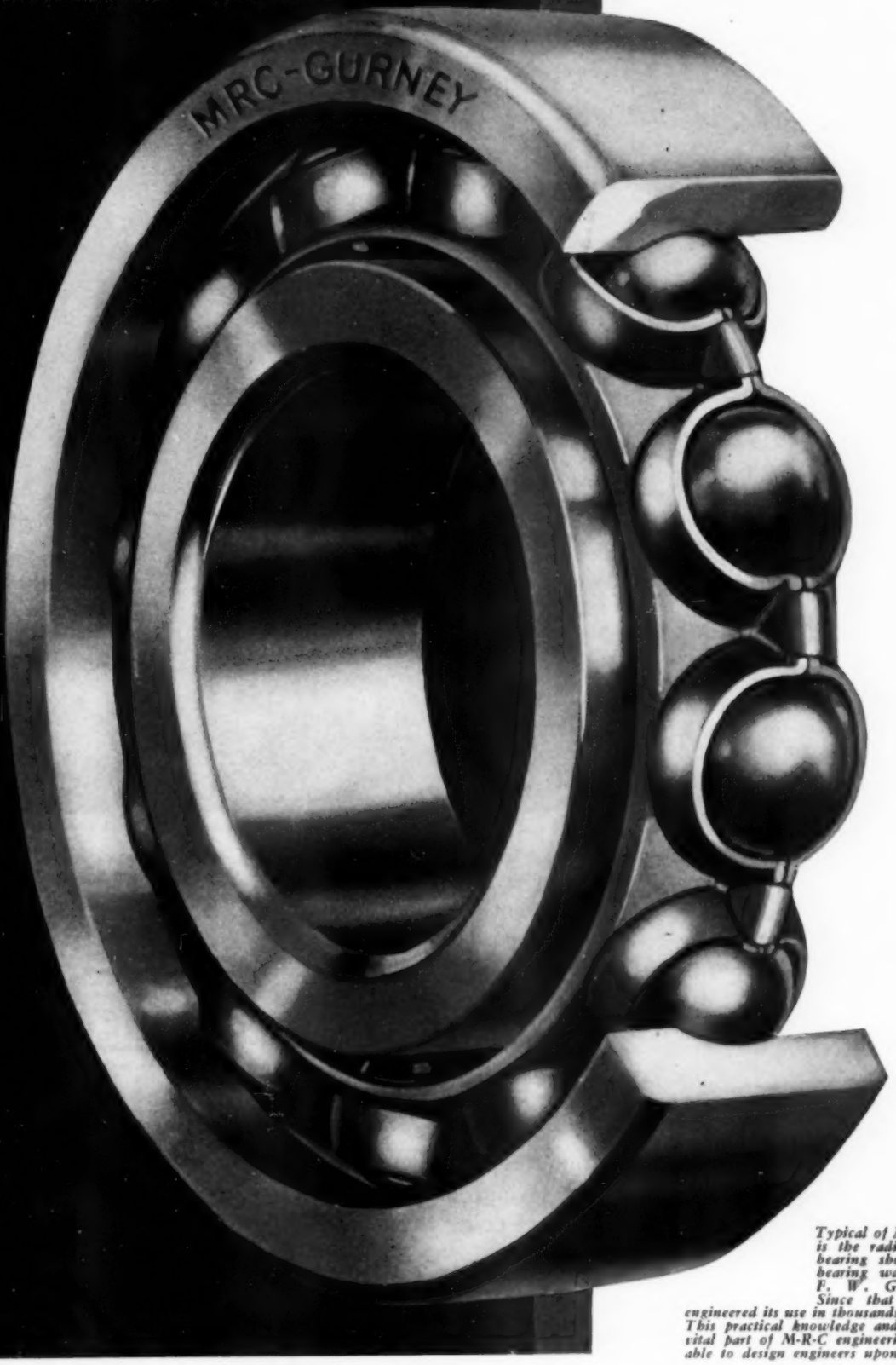
*Executive Offices:* JAMESTOWN, N. Y.

*Factories at: Jamestown, N. Y. Plainville, Conn. Chicago, Ill.*

***Manufacturers of***

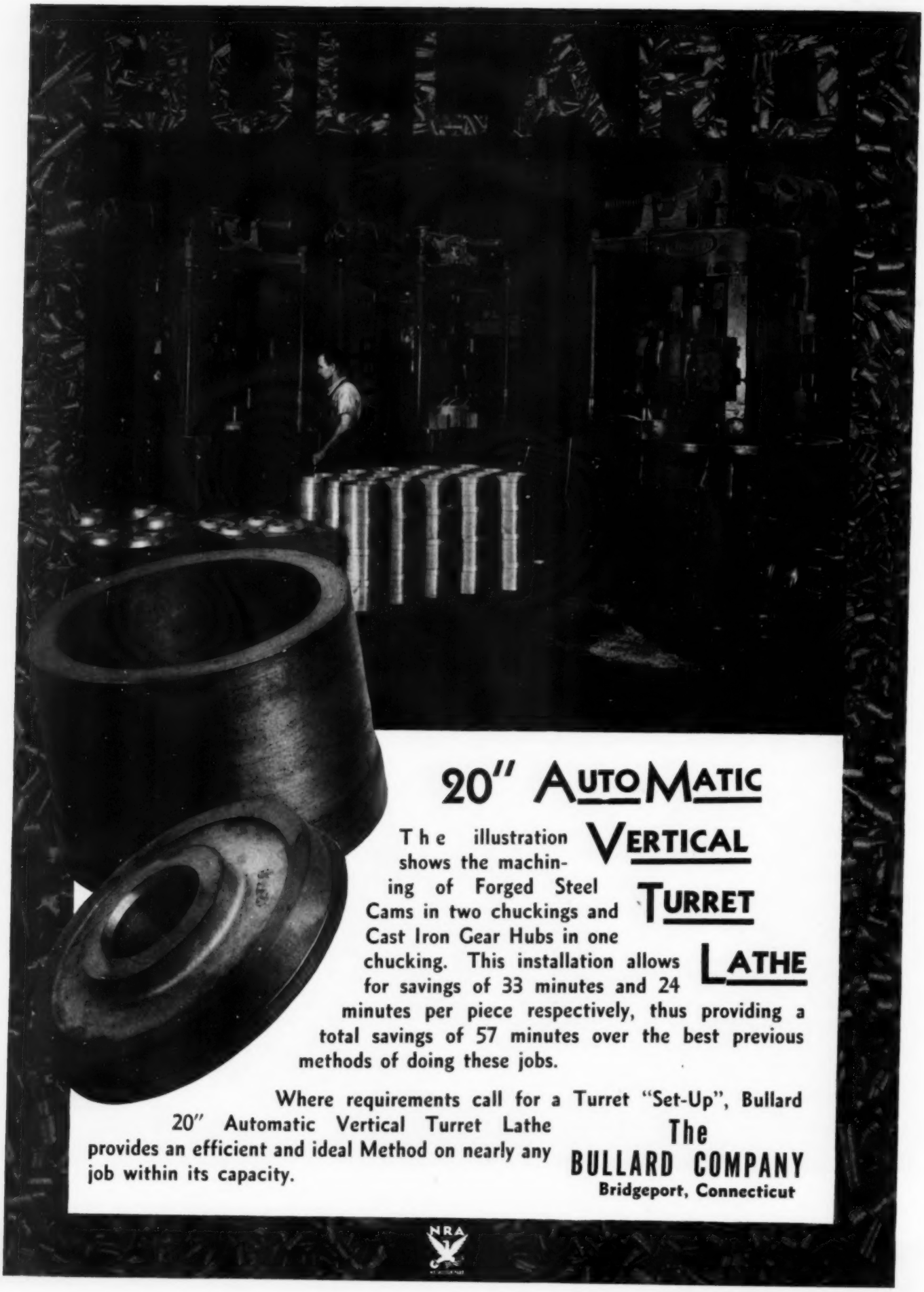
**• GURNEY**

# TRENDS for 1934




*Typical of M-R-C leadership is the radio-thrust type of bearing shown here. This bearing was originated by F. W. Gurney in 1909. Since that time we have engineered its use in thousands of applications. This practical knowledge and experience is a vital part of M-R-C engineering service available to design engineers upon request.*

**SRB • STROM • BALL BEARINGS •**

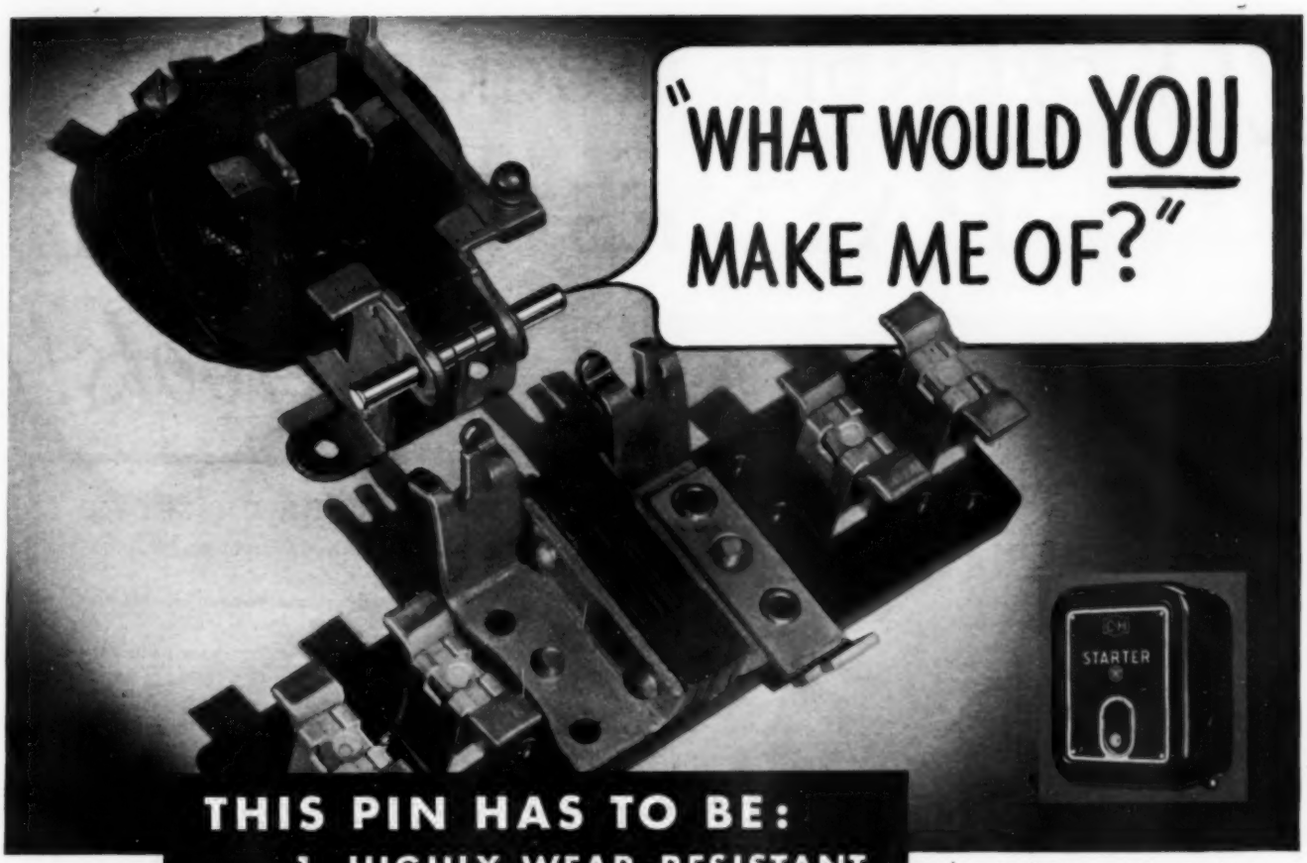


# 20" AUTOMATIC VERTICAL TURRET LATHE

The illustration shows the machining of Forged Steel Cams in two chuckings and Cast Iron Gear Hubs in one chucking. This installation allows for savings of 33 minutes and 24 minutes per piece respectively, thus providing a total savings of 57 minutes over the best previous methods of doing these jobs.

Where requirements call for a Turret "Set-Up", Bullard 20" Automatic Vertical Turret Lathe provides an efficient and ideal Method on nearly any job within its capacity.

**The BULLARD COMPANY**
**Bridgeport, Connecticut**




## THIS PIN HAS TO BE:

1. HIGHLY WEAR-RESISTANT
2. NON-MAGNETIC
3. VERY SMOOTH...

*Showing (left) magnet frame and coil, with hinge pin assembled; also contact bar (right) which hinge pin carries. Parts of Cutler-Hammer "AAA" Motor Starter.*

THIS METAL HINGE PIN is a mighty important part of the famous Cutler-Hammer "AAA" Motor Starter. Only a small part . . . but just look over the qualities it must have! Finding the required combination in one metal presented a real problem.

*High wear-resistance* wanted to withstand the constant movement of contact bar against hinge pin; back and forth, often 4 or 5 hundred thousand times or more in its anticipated life of 15 to 20 years.

*Non-magnetic,* because a non-magnetic material is essential for this electrical equipment use.

*A smooth surface* to minimize friction.

Hard Bronze was highly desirable. It was non-magnetic. And it had fair wearing qualities. But it wasn't wear-resistant enough. Furthermore, it was a "rough surface" metal.

*Solution:* Chromium plate the bronze!

*Result:* 150% increase in wear life; non-magnetic; an exceptionally smooth surface.

When you are up against a metal wear or corrosion problem, investigate the possibilities of chromium plating. Write us about any such problem you encounter. We would welcome an opportunity to advise you and to furnish information.

★

### *Chromium Plating Facilities*

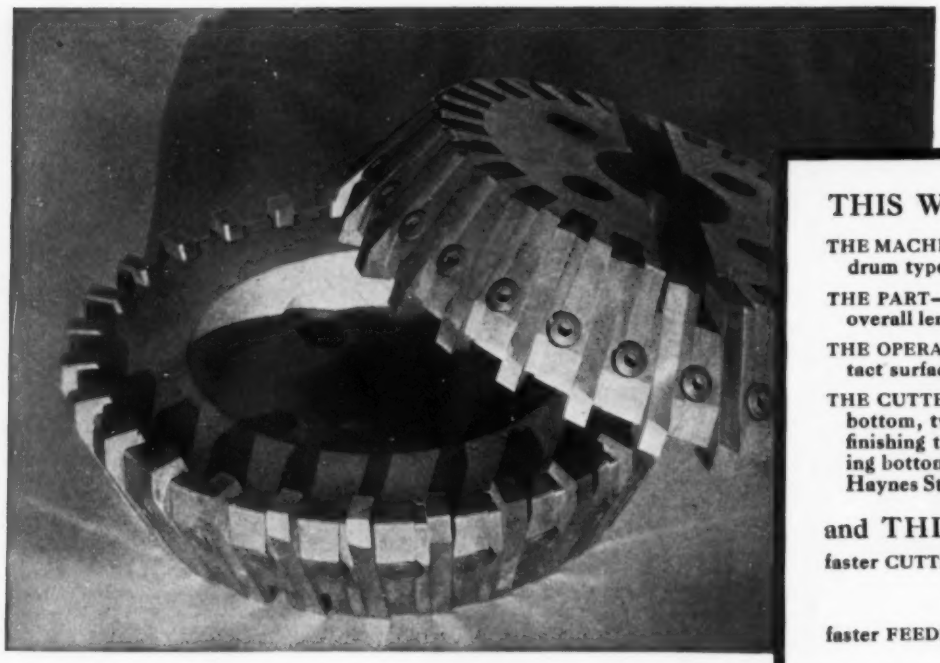
To manufacturers desiring to chromium plate, United Chromium, Inc., under its standard licensing arrangement, makes available the chromium plating process and a helpful engineering service.

When volume of chromium plating work does not warrant the installation of plating facilities, we are glad to recommend a near-by licensed job plater who has the benefit of our experience and cooperation.

# UNITED CHROMIUM
## INCORPORATED

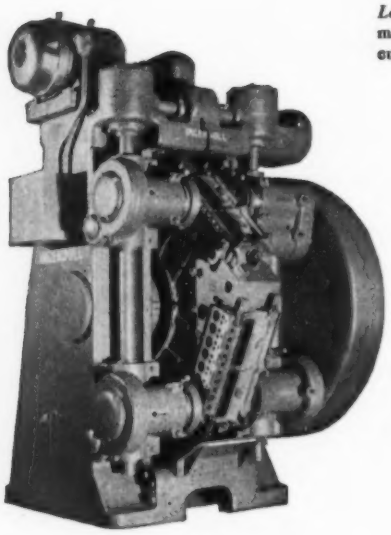
Executive Offices: 51 East 42nd Street, New York City . . . Detroit, San Francisco, Waterbury

# 20 CYLINDER BLOCKS *per hour with* HAYNES STELLITE *tools!*



*Above*—Haynes Stellite inserted blade milling cutters.

*Left*—Ingersoll drum type continuous milling machine equipped with Ingersoll type Q milling cutters filled with Haynes Stellite blades.



**THIS WAS THE JOB SET-UP**

THE MACHINE—Continuous Milling Machine, drum type

THE PART—an 8-cylinder automobile block—overall length, 32 in.

THE OPERATION—milling cylinder head contact surface and oil pan rail

THE CUTTERS—two 9 in. cutters for roughing bottom, two 12 in. cutters for roughing and finishing top and one 17 in. cutter for finishing bottom. All cutters filled with Standard Haynes Stellite Blades.

**and THIS WAS THE RESULT**

| | |
|---|---|
| faster CUTTER SPEEDS . | Peripheral cutter speed 100 ft. per minute |
| faster FEEDS . . . . . | 19 in. per minute at outer edge of cut |
| shorter TIME . . . . . | 3 MINUTES per piece |
| higher PRODUCTION . . | 20 CYLINDER BLOCKS per hour |

A typical instance of modern production with HAYNES STELLITE Cutting Tools permitting increased speeds, faster feeds—*lower* tool cost and lower cost per piece machined.

● You can increase production and lower tool costs in your plant by utilizing increased speeds and greater feeds permitted by Haynes Stellite tools. Because of their inherent hardness, which is practically unchanged at red heat, they maintain their initial efficiency.

Haynes Stellite tools are available in standard sizes for immediate shipment and we are prepared to make prompt delivery on special Haynes Stellite tools. We suggest that you test them in your own plant. Haynes Stellite engineers will be glad to assist you in conducting your tests or tooling your jobs. This service is available without obligation. Write for complete details today.

HAYNES STELLITE TRADE MARK

*A red-hard, wear-resisting alloy of Cobalt, Chromium and Tungsten*

## HAYNES STELLITE COMPANY

*Unit of Union Carbide and Carbon Corporation*

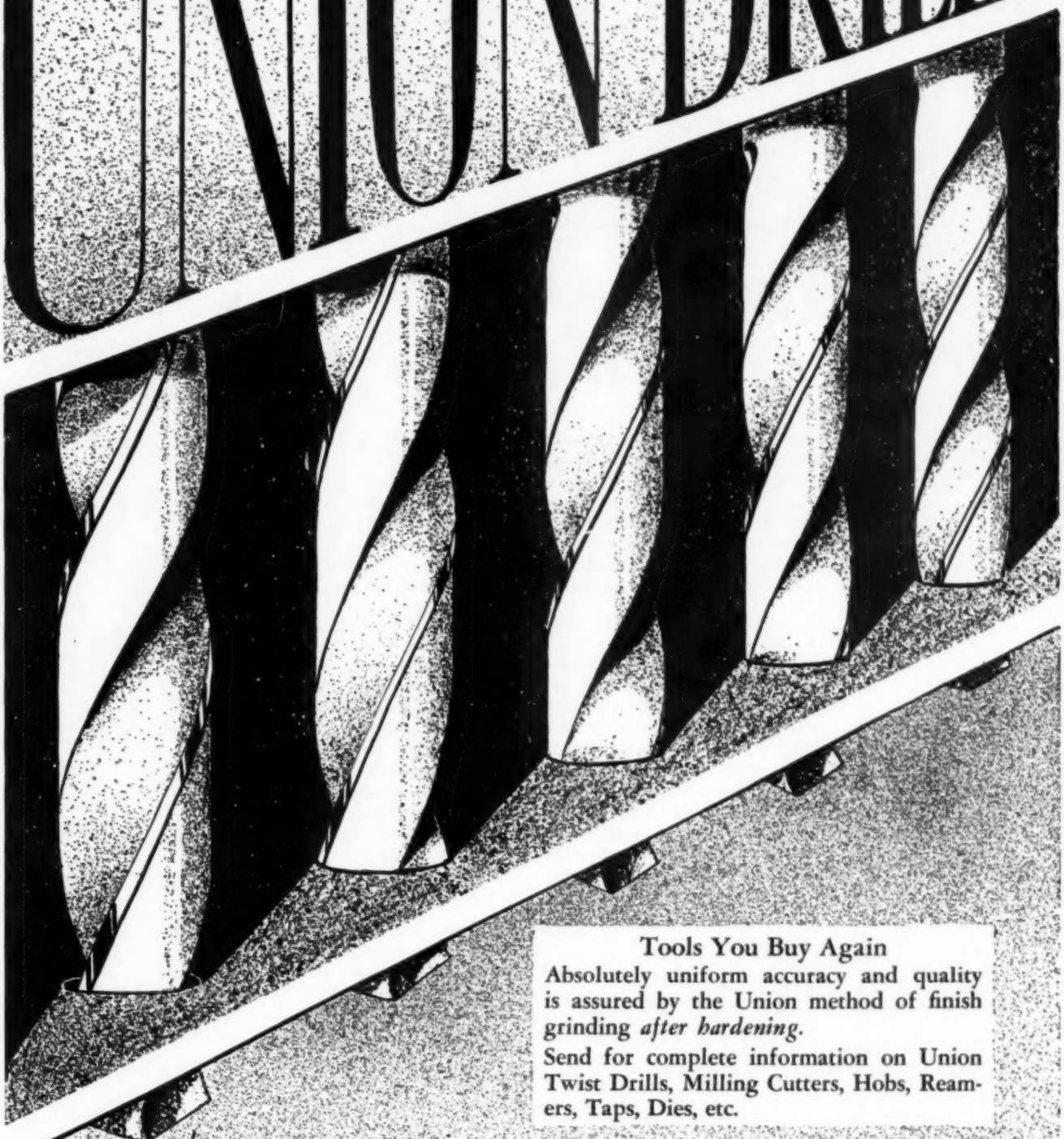
UCC

Chicago - Cleveland - Detroit - Houston - Los Angeles - New York - San Francisco - Tulsa

*General Office and Works*—Kokomo, Indiana
*Foreign Sales Department*—New York City

*Haynes Stellite Welding Rods and information on other Haynes Stellite Products also are available through the 42 apparatus shipping points of The Linde Air Products Company*

# UNION DRILLS



**Tools You Buy Again**

Absolutely uniform accuracy and quality is assured by the Union method of finish grinding *after hardening.*

Send for complete information on Union Twist Drills, Milling Cutters, Hobs, Reamers, Taps, Dies, etc.

## Union Twist Drill Co., Athol, Mass.

New York Store: 62 Reade St.
Derby Line, Vt.

San Francisco Store: 121 Second St.
Mansfield, Mass.

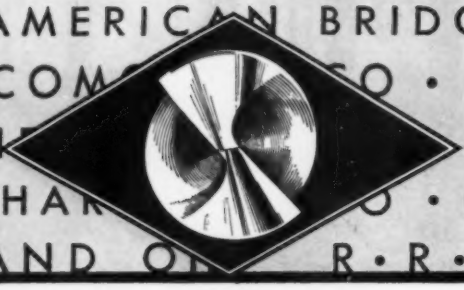
Chicago Store: 11 So. Clinton St.
Rock Island, Quebec

Representatives Throughout the World

# THEY BEGAN USING SELLERS DRILL GRINDERS BEFORE 1900

• • •

CO • 1890 • • AMERICAN BRIDGE CO • 1898 •
AMERICAN LOCOM CO • 1872 • • UNITE
97 • • BETHLEH 1880 • • CONS
BROWN AND SHAR O • CARNEGIE STE
CHESAPEAKE AND O R • R • 1896 • • GENER
JONES A CO • 1880
WORTHIN POOLE E
1855 • CO NG AND D
CO • OF N 900 • ES
BS • • DET PLATE C
ROLLING YOUNGS
MILL CO 892 • AC
CORP • • D AMP MI
1885 • • CO HARVEST
LAR COR 886 • • T
MILLING CONSTRU
ENGINEE AND LAU
STANDA ON • • CARN
1895 • • DE CHESAP
5 • • ENGIN CORP OF
ARCHITE ST • • BRO
UNITED S STEEL • •
HAVE • • CO PUMP CO
WATER S 96 • • WOR
INTERNATIONAL HARVESTE CO • 1897
CORP • JONES AND LAUGH CO • 18
NEWPORT NEWS SHIPBUILD DOCK C
WESTINGHOUSE ELECTRIC A CO • 1889 •



## *Repeat Orders tell the Story • •*

**The list of prominent concerns that have been consistent users of Sellers Drill Grinders for 25 to 50 years, and who have recently again reordered, is conclusive evidence of selection based on long and favorable experience. Likewise, the fact that these and many other firms purchased Sellers Grinders during 1930, 1931 and 1932 is indisputable proof that "bad times" are good times to invest in the obvious economies of this cost-cutting machine.**

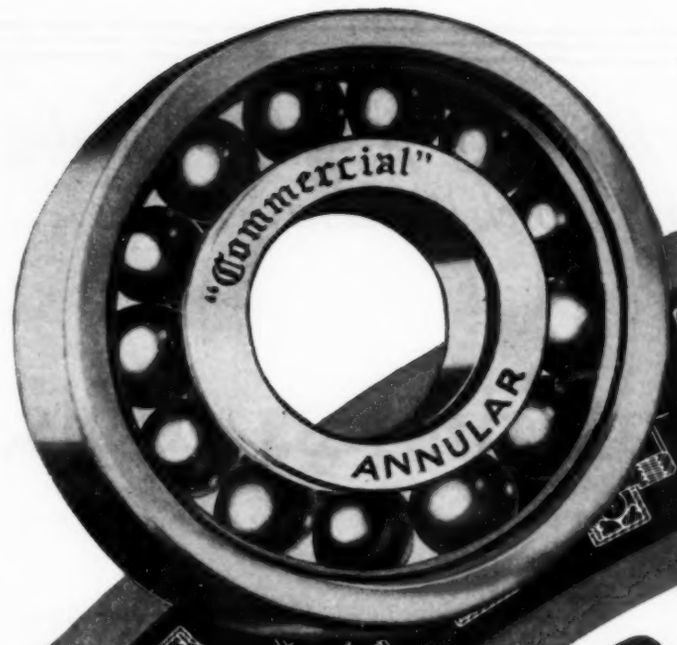
**Its features—of utmost value in any machine shop—are: (1) Inherent accuracy, that is maintained year in and year out. (2) Speed, which cannot be matched by any other machine of its type for rough and finishing grinding. (3) Flexibility—the same chuck, without additional parts, takes any size drill within the machine's range. (4) Efficiency — it automatically produces the Sellers drill point, the point advocated as correct by leading drill manufacturers. This is the point with cutting edges of equal length and angles, and proper clearance for each lip, increasing at the correct rate toward the center. This is the point that produces more holes per grind; that speeds production; produces true cylindrical holes; facilitating assembly; thus cutting manufacturing costs.**

**Investigate your drilling conditions. Send us six or more of your own twist drills (5/16" to 3") to be ground on the Sellers Grinder. Try them on your own work as against drills ground by any other method. Compare drilling speed, quality of holes, number of holes per grind. Find out the truth about drill grinding. No obligations.**

**WILLIAM SELLERS & COMPANY**
ESTABLISHED 1849 **INCORPORATED** PHILADELPHIA, U.S.A.

**SELLERS MACHINE TOOLS**

*Typical installations are shown herewith*

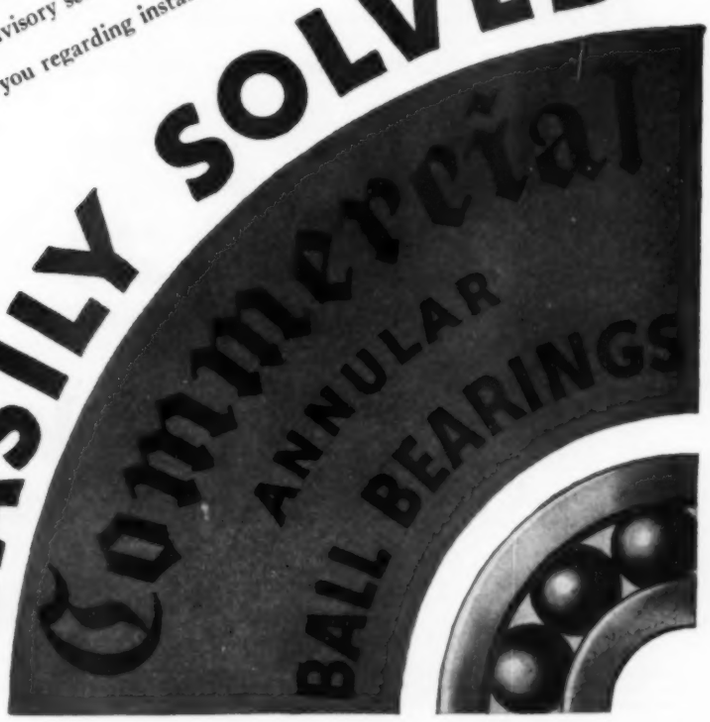





# BEARING PROBLEMS EASILY SOLVED

If you have a bearing problem, we can help you solve it. Difficult installations; complicated designs; unusual requirements. No matter what the problem, our Engineering Staff will be glad to submit special designs to exactly meet your requirements.

We not only make bearings for every conceivable purpose, but offer an advisory service available to *all* manufacturers. May we be of assistance to you regarding installation problems and the economical use of bearings?




"Commercial" Annular Ball Bearings are inexpensive self-contained, anti-friction bearings. Available in many sizes and types at moderate cost.

THE SCHATZ MANUFACTURING CO.
**Poughkeepsie, N. Y.**

Detroit Sales Office: 2608 Book Tower
Chicago Sales Office: 120 N. Peoria St.

*Reader: the January 17 issue is your old friend, the Catalog and Review Number which lists and describes....*

# 700 new machines, tools,

Buying is always serious business. Well do we know how much time and sweat you put into searching, studying catalogs, writing letters, interviewing, planning, and figuring, to buy the right thing.

Hence our Annual Catalog and Review Number. We want to chop something, at least, off your searching and studying job. So we gather together all the new things that you can use in production, and catalog them all in one place. And hundreds of manufacturers use the occasion to present their own statements about their products, in an extensive advertising section. This is the only place where you can get all this information so completely and conveniently.

### *To Help You Make Money Under the Codes*

Are you like all the other production executives we know? If so, your chief problem right now is to keep on manufacturing under higher wages and shorter hours, at a price which people can pay, who haven't yet received any big increases in their "purchasing power". It would look as if only rubber arithmetic could make this possible.

But there is *one* sure way to do it . . . by using the modern equipment.

This is nothing new. Our fathers and grandfathers were forced to take refuge in better equipment when labor costs went up. The new equipment was relatively simple in those days, but with it they usually made more money.

### *What One Man Did*

Last week, the works manager of a large electrical manufacturing company told us that he is actually manufacturing today for a lower cost per unit than before the codes.

He has given his labor shorter hours, and raised the hourly rate. In nearly every case, he has preserved the workman's previous weekly income.

*But,* he has stopped using his obsolete machines; so, a considerable part of his equipment is idle. His best machines, however, he is using on three

# Coming on J

# Annual Review AND

## *of* AMERICAN M

# and production accessories

## ...put on the market this year

shifts a day. He put $50,000 into new tool-room equipment; his most expensive workmen are now much bigger producers. He is "all set," because of able management based on realities.

*Greater Machine-Earning-Power*

The tool and equipment companies have been improving their products right along, despite the Depression . . . with greater accuracy, higher speeds, built-in motors and control, greater refinements in the electrical system, hydraulic operation, welded frames, anti-friction bearings, better lubrication, alloy steel parts, etc., etc. So you can buy today a host of machines, tools, and accessories, that make those of several years ago look embarrassed.

*Don't Miss This Issue*

It comes with your regular subscription. Extra copies are 35 cents.

Lend your copy to your associates, but be sure to get it back . . . you'll need it.


**To the Equipment Manufacturer**

Need we point out that this issue is a fine place for you to advertise?

The thousands of regular readers of American Machinist will be glad to have your own statement about your products . . . in the same book with this complete catalog of production equipment. The more complete it is, the better they like it.

Advertising forms close on Wednesday, January 3. Write, wire, or telephone your space reservation.

AMERICAN MACHINIST

330 West 42nd Street New York


# January 17

# Catalog Number

# MACHINIST.

# CARD
## Machine Screw
# TAPS

*High Speed Steel Cut Thread*

**No. 1121 Regular**

**No. 1122 Spiral Pointed**

**Features . . .** **No. 1120 Regular in plug style in 2, 3 or 4 flutes according to size. Spiral Point in 2 flutes.**

**Cut-back relief — plugging ground.**

**Maximum tolerances for longer life.**

**Faster speeds, more holes per tap.**

**Recommendations . . .** **Use 2 or 3 fluted taps for machine tapping.**

**Use spiral pointed taps for through holes in all metals.**

**Try these taps for fast production tapping. They are being run three to four times faster than Carbon Steel and last much longer.**

*Sold by leading dealers everywhere*

**Send for folder on designs and recommended uses of CARD Machine Screw Taps.**

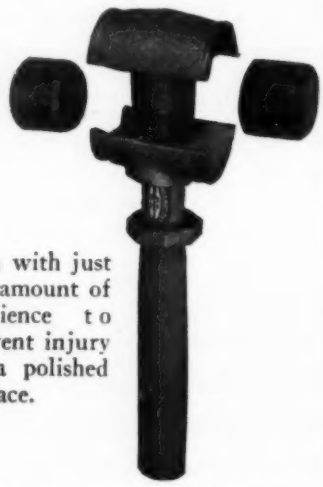
**S.W.CARD MFG. CO.**
**DIVISION OF UNION TWIST DRILL CO.**
**MANSFIELD, MASSACHUSETTS, U.S.A.**

## A Clean Blow Without Injury To Surface Struck

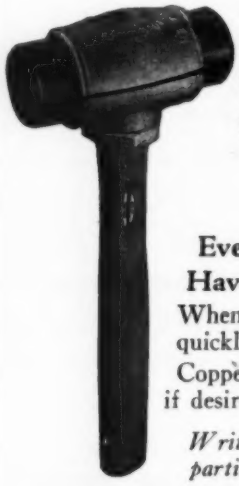
# *The* "BASA" HAMMER

with removable rawhide faces can deliver a light or heavy blow without leaving a trace of damage.

The "BASA" Hammer is of improved design and construction. Each of the five sizes has the exact weight to give the proper balance to strike a measured blow.



The rawhide faces are firm with just the amount of resilience to prevent injury to a polished surface.



**Every Machine Shop Should Have a "BASA" HAMMER**

When worn, Rawhide Faces can be quickly renewed at *small cost.*

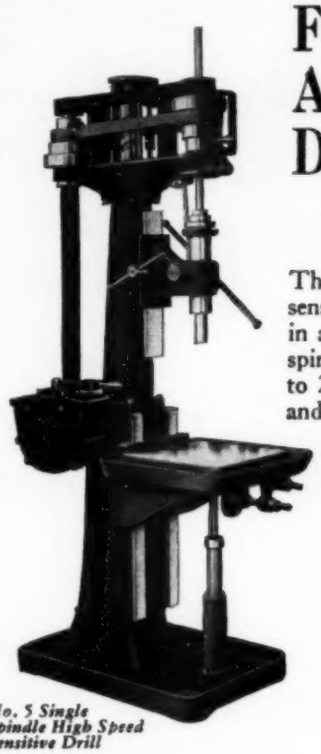
Copper and Babbitt faces furnished if desired.

*Write for particulars*

**GREENE, TWEED & CO.**
***Sole Manufacturers***
**109 Duane St., New York**

# FOR LIGHT ACCURATE DRILLING

## At Low Cost Per Hole



*No. 5 Single Spindle High Speed Sensitive Drill*

The Fosdick ball bearing sensitive upright drill comes in a complete line of 1 to 6 spindles in sizes from 16" to 24". Careful inspection and supervision throughout each step in its manufacture and severe working tests before shipment insure absolute reliability.

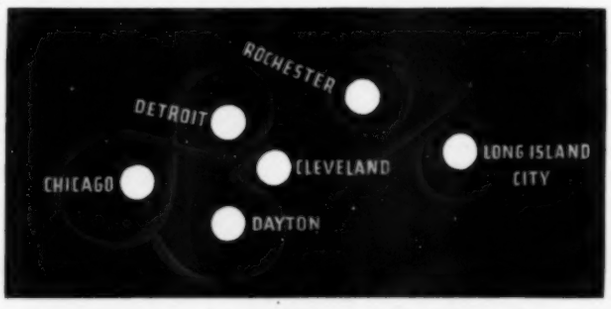
We build also a complete line of **Economax Heavy Duty Radials** in sizes from 3' to 8' and **Heavy Duty Upright Drills** in three sizes 21", 25" and 30".

*Write for complete information and details.*

FOSDICK

THE FOSDICK MACHINE TOOL CO., Cincinnati, Ohio.





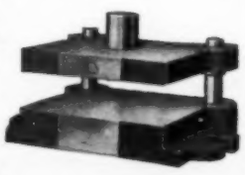

# FOR 85% OF INDUSTRY

### There is a source for better die sets at lower final costs

Better than any competitive set can offer, because on less than Danly's volume, no competitor can afford to match either Danly's machine tool facilities, which lower costs, or Danly's unique Branch Office-Plant set-up which makes Danly Die Sets available at every point encircled above within 24 hours under normal circumstances —and we will break our neck to lick circumstances when necessary.

And, speaking frankly, better than home-made sets, because no individual manufacturer can maintain the specialized force of artisans, and the specialized machine set-ups that Danly uses in the volume production of Danly Die Sets.

The six Danly Branch Office-Plants, covering collectively the area in which more than 85% of the plants fabricating metals are located, are maintained because, under the Danly Plan, they can furnish better die sets at lower final costs—and quicker deliveries.



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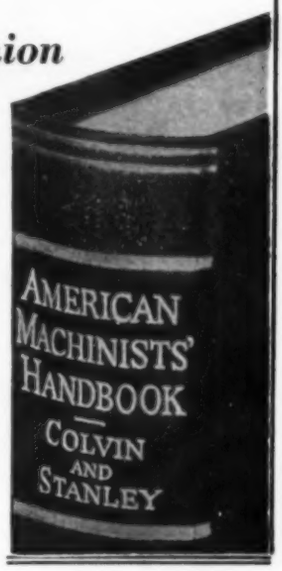


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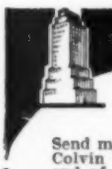

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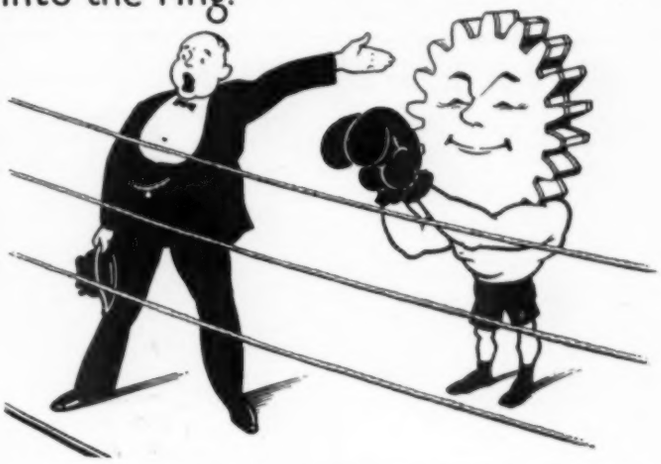

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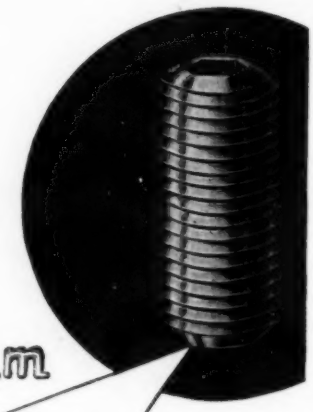

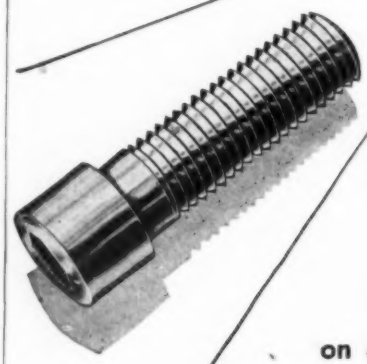

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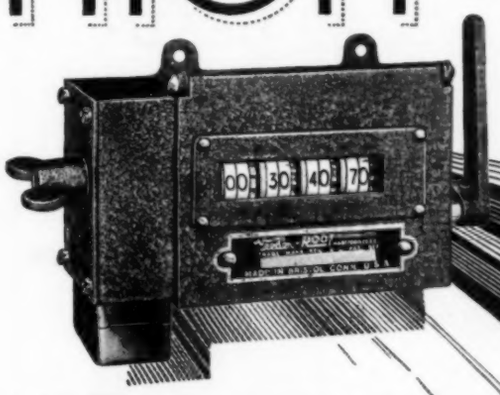

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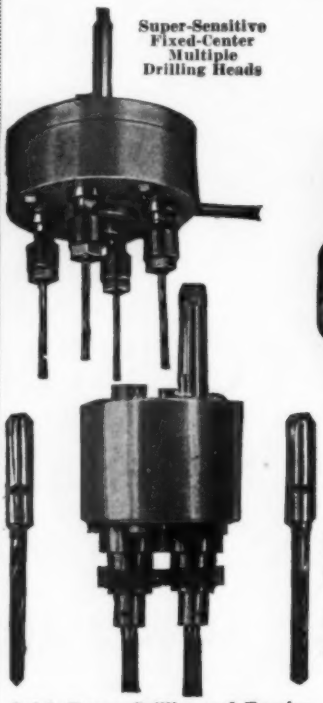

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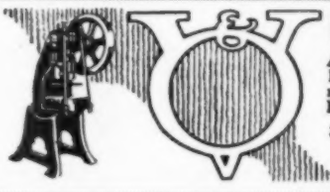

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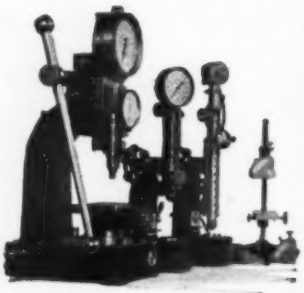

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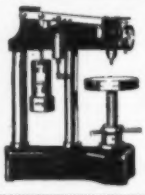

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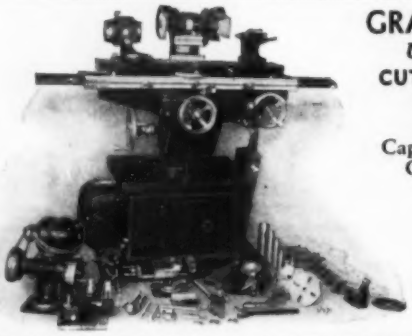

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**SCREW Driving Machines**
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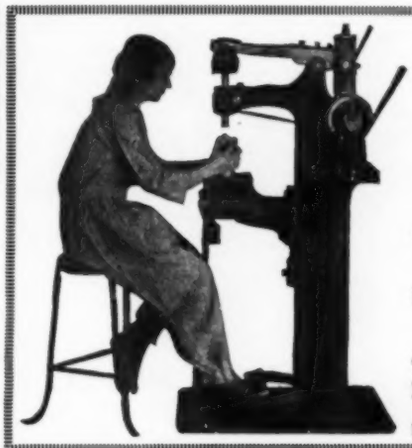

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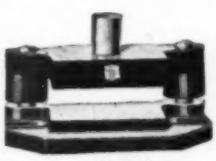

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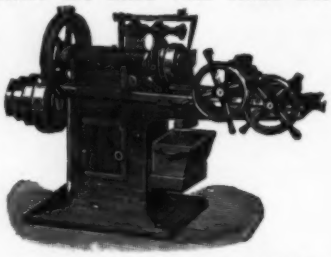

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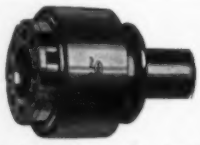

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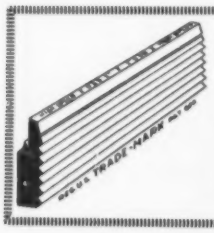

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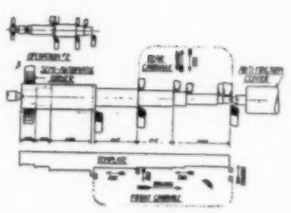
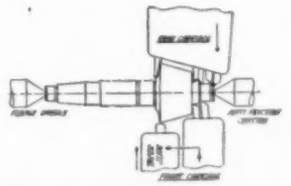


A typical example of step-shaft turning on the Magna-Matic showing the template and a practical application of the Monarch *Automatic Feed Step-up*. Note that a different feeding rate is provided for each diameter.



Another example of step shaft turning on the Magna-Matic It shows the use of a different feeding rate for the single diameter turning tool by means of the *Automatic Feed Step-up*. This exclusive Monarch feature cuts production costs and provides approximately the correct feeding rate for the depth of cut.

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7. Automatically lubricated throughout.
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9. Adapted for automatic chucking, facing, boring, and turning between centers.
10. The *most universal* automatic lathe.

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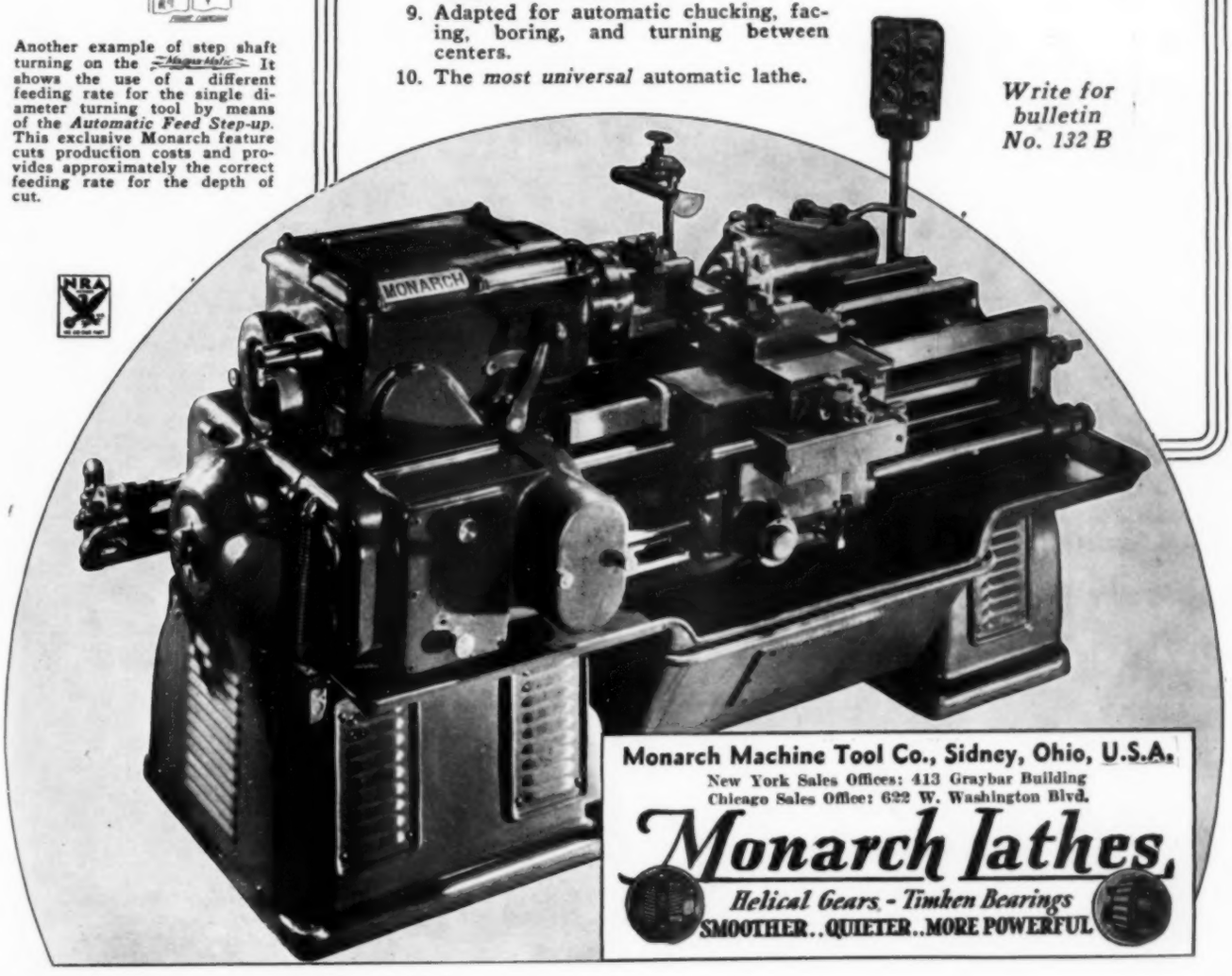


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*Helical Gears - Timken Bearings*

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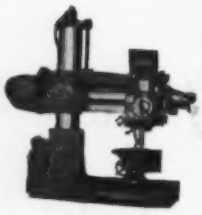
## Twelve Years Satisfaction



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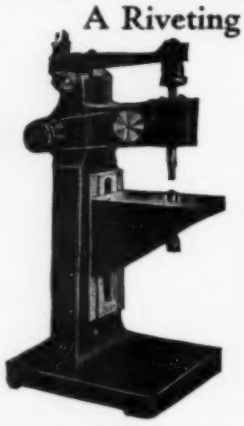
## A Riveting Problem?



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